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IN THIS ISSUE

THE results of physical examinations of infants at birth and one month of age are presented by Alexander Randall, IV, M.D., *et al.*, in a report "Clinical Findings at Birth and One Month for Babies of Mothers Receiving Nutrient Supplements," the fourth of the newborn studies in the series, "Maternal and Newborn Nutrition Studies at Philadelphia Lying-In Hospital." The prevalence among the infants in the Study of about fifty different conditions is shown and related to the nutritional supplements taken by the mothers during pregnancy. It is concluded that the supplements have only a minor effect upon the physical condition of the babies during the first month of life. Also considered are certain difficulties which were encountered and which affect the consistency of the data in a long-term study of this type.

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At the outbreak of World War II, the Norwegian State Dental School immediately made plans to study dental caries in school children for the duration of the War and for several post war years. The study was stimulated by reports from several European countries, including Norway, after World War I that a marked reduction in dental caries in children had occurred. The prospect of another long war with similar changes in living conditions, especially in food supplies, presented an opportunity for more extensive observations on any changes in dental caries that might accompany conditions imposed by the war. With the cooperation of dentists in twenty-two widely scattered school districts in Norway, arrangements were made for annual examinations of school children and for records to be sent to the

Dental School in Oslo. The examinations were started in September, 1940, and continued through the school year 1948–1949; and, in order to extend the period of post war observations, examinations in many of the same districts were obtained for the school year 1951–1952 and 1952–1953.

The study was directed by Dr. Guttorm Toverud, Professor of Pedodontia at the Norwegian State Dental School, who also has analyzed the data. His report on "The Influence of War and Post-War Conditions on the Teeth of Norwegian School Children" will be published in the *Quarterly* and the first section is in this issue. The first section is on "Eruption of Permanent Teeth and Status of Deciduous Dentition." Later sections will present the data on changes in dental caries in the permanent teeth.

During the war years, a delay in eruption of permanent teeth is found for children of all ages from 7 years to 12 years. This later eruption was most marked at the end of the War and persisted for several years; it was greater for some teeth and at some ages than others. Reversal of the delay became evident soon after the War for the youngest children and by 1952 and 1953 a trend toward earlier eruption of the permanent teeth is noted at all ages; but the eruption time for most teeth was still somewhat later than at the start of the study. Delay in eruption of the permanent teeth is associated with later loss of the deciduous teeth for which a great reduction in caries is found. After the War, caries in deciduous teeth increased sharply and loss of these teeth at an earlier age is noted in 1952–1953. The factors involved in the reduction of caries in deciduous teeth, their persistence in the mouth for an extended period and in the changes in age of eruption of permanent teeth are discussed and the importance of nutritional factors is evaluated.

MATERNAL AND NEWBORN NUTRITION STUDIES AT PHILADELPHIA LYING-IN HOSPITAL*

NEWBORN STUDIES. IV. CLINICAL FINDINGS AT BIRTH AND ONE MONTH FOR BABIES OF MOTHERS RECEIVING NUTRIENT SUPPLEMENTS

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THE effect of nutritional supplementation of the mother's diet during pregnancy upon her infant was one of the topics of major interest of the Nutrition Study at the Philadelphia Lying-in Hospital. This effect has been investigated in terms of the infant's size at birth and his growth during the subsequent three months (1) and, in a preliminary report, by analysis of the observations from the physical examination of each infant during the first few days of life (2). The present report will deal in more detail with the results of the examinations at birth as well as those at one month of age and will relate these results to the nutritional supplements taken by the mother.

The Study population was composed of the women who came to the Clinic of the Hospital during the first sixteen weeks of pregnancy. They were referred to the Nutrition Clinic where they were assigned to one of four groups, on a random basis controlled for race, age, and gravida. One group was designated as the control and given no nutritional supplement, the second group was given vitamins only, the third group was given only a protein supplement, and the fourth group received both vita-

* The Nutrition Studies at Pennsylvania Hospital (Philadelphia Lying-in Hospital) were supported by grants-in-aid from the Milbank Memorial Fund, The Williams-Waterman Fund, the National Vitamin Foundation, the Upjohn Company, E. R. Squibb and Sons, and in part by the Nutrition Foundation and Mead Johnson & Company.

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mins and the protein supplement.[4] All women on their first visit to the Clinic were given the same diet instructions, which were re-emphasized on subsequent visits.

The babies included in this Study were born between 1949 and 1952. Those weighing less than 5.5 lbs. at birth have been excluded from this analysis since most of them were in the premature nursery and not available for examination. Twins and infants of mothers with syphilis or a severe chronic desease[5] have also been excluded. The babies were subject to the routine nursery care of the Hospital and no distinction was made between the Study babies and the rest of the infants in the nursery.

The newborn physical examination was carried out in the nursery during the first few days after birth—79 per cent being performed within the first seventy-two hours of life. Almost all of the examinations were performed by two pediatricians; one (A.R.) doing about 76 per cent, and the other (J.R.) about 21 per cent, most of the latter being done during the first part of the Study. In addition, a third physician did the examinations on a small group of thirty babies toward the end of the program. Birth examination records are available for 992 infants, of whom 732 are white and 260 Negro. The Study group to which the mother of the baby belonged was not known to the physician at the time of the examination.

During the birth examination the physician checked on forty-eight attributes of the baby. Some of them were of the type usually included in a pediatric examination; many of the others, not commonly recorded, were believed to be related in some manner to the nutritional status of the mother or infant.[6] Dur-

[4] The nutrient supplements used in this study are: Therapeutic polyvitamin concentrate (Upjohn's Zymacaps and E. R. Squibb & Sons' Theragran) three capsules per day; Protein concentrate (Mead Johnson & Company's Protenum), to furnish 50 gms. of protein daily if taken as advised.

[5] Patients with chronic disease or syphilis referred to the Nutrition Research Clinic were carried but have been excluded from tabulations in this report. Chronic diseases excluded are essential hypertension, chronic heart classified II-a or higher, chronic nephritis, and chronic pyelitis.

[6] The list of conditions was selected by the following advisory committee: Dr.

(Continued on page 323)

ing the examination the pediatrician would note the presence or absence of each condition; and, if present, whether to a slight, moderate, or severe degree. The information was recorded by a secretary at the time of examination on a standard form. Some items were added to the examination schedule as the study progressed, so that the number of infants observed is not the same for all conditions.

The examination at one month was performed in much the same manner. A few of the conditions looked for at birth were not included in this examination, while a few others were added to the list. Since the infants had to be brought to the Clinic for this examination there was less uniformity with respect to age at examination. A few were seen as early as the middle of the second week of life and some as late as the end of the fifth week, but most were examined between twenty-six and thirty-four days of age. The number of babies examined at one month was 912—639 white and 273 Negro. About 63 per cent of the examinations were done by one pediatrician (J.R.) and 33 per cent by the second (A.R.), with the remainder being done by other staff physicians.

Results of the Examinations at Birth

The occurrence of each of the conditions on the newborn physical examination is shown in Table 1, which gives the percentage of babies in whom each condition was observed in any degree of severity and the percentage in whom the condition was considered moderate or severe. Two items are not included in the table, masses in abdomen and spleen palpable, of which there were 0 and 1 occurrences, respectively. For certain findings there was sufficient difference in prevalence between the white and Negro infants to justify a separation by race. A more frequent occurrence among white than among Negro babies was noted for overlapped sutures, abnormal hair distribution, skin

Joseph Stokes, Jr., Dr. Charles C. Chapple, and Dr. Thomas F. M. Scott, of Children's Hospital, Philadelphia; Dr. Edwards A. Park, Baltimore; Dr. Harry D. Kruse, Academy of Medicine, New York City; and W. M. Krogman, University of Pennsylvania.

Table 1. Prevalence of conditions on newborn physical examination.

Condition	Per Cent with Condition								Number of Infants Observed			
	Any Degree				Moderate or Severe							
	Total	Case Number			Total	Case Number			Total	Case Number		
		Under 1,000	1,000–1,599	1,600 and Above		Under 1,000	1,000–1,599	1,600 and Above		Under 1,000	1,000–1,599	1,600 and Above
Abdomen												
Liver Palpable	3.5	8.9	0.3	0.4	0	0	0	0	989	370	372	247
Diastasis Recti—White	24.0	40.2	16.8	9.1	19.7	35.3	11.5	7.8	699	266	279	154
Diastasis Recti—Negro	28.3	46.3	26.6	17.2	20.5	34.3	16.0	15.1	254	67	94	93
Lungs—Rales	0.4	0.9	0.3	0	0	0	0	0	928	324	360	244
Lymph Nodes—Enlarged	0.7	1.9	0	0	0.1	0.3	0	0	980	367	366	247
Genitalia												
Hypertrophy	68.7	55.6	64.1	79.4	37.8	25.0	35.9	44.4	693	72	373	248
Pigmentation—White	33.7	21.4	32.0	41.3	6.3	3.6	6.1	7.7	489	56	278	155
Pigmentation—Negro	97.0	93.8	95.7	98.9	90.1	81.3	87.2	94.6	203	16	94	93
Undescended Testes	2.8	5.4	1.0	1.5	0	0	0	0	536	205	200	131
Vaginal Discharge	23.2	34.2	18.6	15.7	4.4	3.4	4.1	6.1	436	149	172	115
Hydrocele	2.6	3.4	3.0	0.8	0.2	0	0.5	0	538	207	201	130
Bleeding	0.7	2.0	0	0	0	0	0	0	434	148	171	115
Breast Engorgement	68.9	50.0	70.3	72.5	19.3	6.9	22.2	18.6	689	72	370	247
Skeleton												
Rib Beading	69.6	60.8	79.4	68.1	20.1	20.8	24.4	12.5	991	370	373	248
Congenital Dislocation of Hips	0.3	0.8	0	0	0	0	0	0	988	368	373	247
Bowed Legs	75.8	42.5	93.6	98.4	34.6	7.0	45.8	58.9	990	369	373	248
Hyperextension of Knees	0.6	1.2	0.5	0	0	0	0	0	949	332	370	247
Head												
Moulding—White	14.4	16.6	13.2	12.4	2.8	3.0	3.3	1.3	722	296	273	153
Moulding—Negro	19.7	21.4	15.4	22.6	7.1	8.6	5.5	7.5	254	70	91	93
Overlapped Sutures—White	17.0	25.6	15.9	4.0	1.0	0.8	1.4	0.7	690	262	277	151
Overlapped Sutures—Negro	9.2	18.2	10.9	1.1	0	0	0	0	251	66	92	93
Open Sagittal Suture—White	82.1	75.1	84.6	89.7	39.5	41.9	32.6	47.7	699	265	279	155
Open Sagittal Suture—Negro	89.3	86.4	87.2	93.5	45.5	50.0	37.2	50.5	253	66	94	93
Open Posterior Fontanelle	81.5	74.9	83.9	87.5	32.7	30.1	30.6	39.9	987	366	373	248
Eyes												
Hyperemia—Lids	89.0	86.2	90.9	89.9	53.5	45.2	59.9	55.1	953	334	372	247
Hyperemia—Sclera	43.7	49.2	43.8	42.1	7.5	7.7	9.6	4.3	654	65	354	235
Discharge	15.3	16.5	15.7	13.0	4.3	2.9	5.5	4.2	916	315	362	239
Hemorrhage—Sclera—White	7.5	8.9	7.1	6.0	1.0	0.5	1.6	0.7	617	213	255	149
Hemorrhage—Sclera—Negro	13.7	14.5	19.0	8.0	1.3	0	3.6	0	226	55	84	87
Circumcorneal Injection	12.0	20.6	10.9	4.3	0.8	1.2	0.6	0.9	828	252	341	235

Tongue												
Red or Purple	50.8	54.7	51.7	44.4	—	—	—	—	954	333	373	248
Papillae Hypertrophy	46.0	36.8	50.7	51.2	15.7	10.9	18.3	18.3	946	329	371	246
Papillae Atrophy	10.3	12.7	10.7	6.5	1.2	1.2	1.1	1.2	950	331	373	246
Fissures	0.8	1.8	0.3	0.4	0.1	0	0	0.4	952	333	373	246
Swollen	44.8	39.2	44.2	53.2	12.4	6.3	15.0	16.5	953	332	373	248
Ankyloglossia	2.3	3.7	1.6	1.6	0.7	0.9	0.5	0.8	940	327	367	246
Gums												
Red or Very Red	6.0	10.8	3.8	2.8	—	—	—	—	952	332	373	247
Hypertrophy	75.3	67.6	74.0	79.4	19.9	21.1	19.8	19.8	692	71	373	248
Pigmentation—White	1.0	1.9	0.7	1.3	0	0	0	0	485	53	278	154
Pigmentation—Negro	13.8	12.5	10.6	17.2	1.5	0	2.1	1.1	203	16	94	93
Central Nervous System												
Moro Reflex	96.2	94.0	97.8	97.2	2.6	6.3	0.8	0	982	365	371	246
Abnormal Cry	4.7	7.8	3.5	2.0	0.1	0.3	0	0	973	357	370	246
Hyperactivity	1.4	2.2	0.8	1.2	0.1	0	0.3	0	936	322	369	245
Drowsiness	4.0	8.4	2.2	0.8	1.6	3.1	1.1	0.4	934	321	368	245
Skin												
Abnormal Hair Distribution—White	74.7	64.4	83.2	79.2	0.8	1.0	1.1	0	723	295	279	149
Abnormal Hair Distribution—Negro	56.5	46.6	63.4	57.3	0	0	0	0	255	73	93	89
Dehydration—White	26.5	28.3	19.4	36.1	8.4	12.5	4.0	9.0	705	272	278	155
Dehydration—Negro	50.0	52.2	37.2	61.3	23.6	28.4	13.8	30.1	254	67	94	93
Edema	1.7	2.4	1.9	0.4	0.2	0.3	0.3	0	950	329	373	248
Bleeding in Creases	12.2	8.3	12.3	17.3	1.7	0.3	2.1	2.8	948	327	373	248
Eruptions—White	8.3	14.2	5.0	3.2	0.4	0.7	0	0.6	722	289	279	154
Eruptions—Negro	3.5	2.8	6.4	1.1	0	0	0	0	259	72	94	93
Toxic Erythema—White	11.8	15.1	9.5	11.1	1.6	1.6	0.7	3.3	684	252	279	153
Toxic Erythema—Negro	4.0	4.9	2.1	5.4	1.2	0	1.1	2.2	248	61	94	93
Hives	2.3	4.2	2.7	1.2	0.4	1.4	0.5	0	690	72	373	245
Hemangioma—Lids—White	30.3	60.7	26.3	26.6	5.1	16.1	4.3	2.6	488	56	278	154
Hemangioma—Lids—Negro	20.2	50.0	14.9	20.4	2.5	6.3	3.2	1.1	203	16	94	93
Hemangioma—Forehead	9.5	17.1	10.0	6.5	1.9	2.9	1.9	1.6	686	70	370	246
Pilonidal Dimple	84.3	70.2	90.9	95.2	0.8	1.1	0	1.6	984	363	373	248
Jaundice—White	35.4	72.0	24.1	21.4	8.1	16.1	6.9	2.6	571	143	274	154
Jaundice—Negro	21.1	57.6	12.9	16.3	2.8	9.1	1.1	2.2	218	33	93	92

eruptions, toxic erythema, hemangioma of the lids, and jaundice, while the greater prevalence was found in Negro babies for diastasis recti, skull moulding, genital pigmentation, gum pigmentation, hemorrhage of the sclera, and dehydration. The differences in prevalence by race for the observations on pigmentation are large, as would be expected, while those on maturation of the skull are of only "borderline" significance. The other conditions mentioned refer primarily to the skin and may reflect either a real difference by race or only a variation in the ease with which such conditions may be observed in babies of the two races. For none of the conditions was a difference in prevalence by sex observed.

Two other types of variation were also found in the observations, which limit their value to some degree. One was a change in the relative frequency of occurrence of many conditions during the course of the Study. The second was an apparent difference between the physicians in their definition of a "positive" finding for a number of the conditions being observed. The change during the Study in the percentage of infants showing each condition is illustrated in Table 1, which gives the percentages for three groups of infants classified on the basis of their case numbers, which were assigned serially to the mothers as they entered the Study.[7] The trends of the percentages during the Study are not uniform for all conditions, but several patterns of change may be observed. For some findings such as hyperemia of the lids and moulding of the skull no change was found. A consistent increase was noted for some items (hypertrophy of the genitalia or gums), and a downward trend for others (diastasis recti and circumcorneal injection). Evidence of initial overreading (liver palpable and jaundice) or underreading (pilonidal dimple and bowed legs) is found for some conditions in which the percentage of occurrence was markedly higher or lower in the first group of infants than in the following two groups.

[7] The "under 1,000" group includes infants with case numbers between 400 and 999 since the physical examinations of infants with case numbers under 400 were not based on the itemized list of conditions used in the later examinations.

There is no basis for deciding whether these trends represent real changes in the prevalence of these conditions during the Study or whether they reflect changing definitions by the examiners of a positive occurrence. Probably both these factors enter into the explanation of the changes in level of occurrence, but the second is likely of greater importance. If that be so, the prevalence observed in the later groups in the Study, representing the increased experience of the examiners, is probably the best index of the presence of these conditions in the Study population.

The second source of variation in the estimate of prevalence of these conditions, the apparent difference between the examining pediatricians in their definition of a positive finding, is demonstrated in Table 2. This table shows the occurrence of each condition for infants classified by examining physician, and is restricted to those infants with case numbers under 1,300 since one of the pediatricians performed almost no newborn examinations after this point in the program. For many items the agreement between the two pediatricians is good, but for some the difference is disturbingly large. In the latter category are such conditions as diastasis recti, open sagittal sutures, open posterior fontanelle, hyperemia of the sclera, and red gums. However, as the Study continued, close consultation between the two doctors resulted in improved conformity to the same standards in defining the occurrence of many conditions. Since no criteria are available to select the examination results of one physician over those of the other, the estimates of prevalence have been based on the combined observations of both doctors.

The observations of the prevalence of these conditions in a moderate or severe degree are also subject to these same types of variation. In addition, since the definitions of a moderate or severe occurrence were not explicitly stated, it is difficult to establish just what this classification means. For most items, the prevalence of moderate or severe occurrence is under 10 per cent, but for a small group of conditions it is considerably larger. For genital pigmentation in Negro infants and diastasis recti

this classification of severity accounts for almost all of the total prevalence. It is possible that the relative frequency of mod-

Table 2. Prevalence of conditions on newborn physical examination by examining physician, for infants with case numbers under 1,300.

Condition	Per Cent with Condition				Number of Infants Observed	
	Any Degree		Moderate or Severe			
	Physician		Physician		Physician	
	A	B	A	B	A	B
Abdomen						
Liver Palpable	2.3	11.9	0	0	343	210
Diastasis Recti—White	24.8	51.1	22.3	36.5	274	137
Diastasis Recti—Negro	23.6	62.7	18.2	37.3	55	51
Lungs—Rales	0.6	1.2	0	0	334	163
Lymph Nodes—Enlarged	1.2	1.5	0	0.5	341	205
Genitalia						
Hypertrophy	62.7	72.6	35.4	40.0	161	95
Pigmentation—White	20.0	47.0	5.2	7.6	135	66
Pigmentation—Negro	88.5	96.6	84.6	79.3	26	29
Undescended Testes	3.1	5.3	0	0	191	113
Vaginal Discharge	26.0	37.9	4.1	2.3	146	87
Hydrocele	3.1	4.3	0	0.9	192	115
Bleeding	0.7	2.3	0	0	146	86
Breast Engorgement	65.8	64.1	16.1	22.8	161	92
Skeleton						
Rib Beading	74.4	57.1	27.6	21.4	344	210
Congenital Dislocation of Hips	0.3	1.0	0	0	344	208
Bowed Legs	64.5	47.4	19.2	8.6	344	209
Hyperextension of Knees	0.9	0.5	0	0	331	182
Head						
Moulding—White	19.1	12.9	5.2	0.7	288	147
Moulding—Negro	25.5	11.8	9.1	3.9	55	51
Overlapped Sutures—White	21.0	31.9	1.5	1.5	271	135
Overlapped Sutures—Negro	14.5	16.3	0	0	55	49
Open Sagittal Suture—White	93.5	43.0	49.8	11.9	275	135
Open Sagittal Suture—Negro	94.5	74.0	52.7	30.0	55	50
Open Posterior Fontanelle	91.0	50.2	34.7	19.3	343	207
Eyes						
Hyperemia—Lids	89.8	84.8	55.9	38.0	333	184
Hyperemia—Sclera	53.3	21.5	13.2	4.3	152	93
Discharge	10.0	33.3	3.1	4.5	319	177
Hemorrhage—Sclera—White	6.1	16.7	0.9	1.7	228	120
Hemorrhage—Sclera—Negro	11.9	22.4	0	6.1	42	49
Circumcorneal Injection	14.3	28.3	0.7	0.7	272	152

Condition	Per Cent with Condition				Number of Infants Observed	
	Any Degree		Moderate or Severe			
	Physician		Physician		Physician	
	A	B	A	B	A	B
Tongue						
Red or Purple	49.5	69.1	—	—	329	188
Papillae Hypertrophy	34.7	55.9	8.9	21.5	325	186
Papillae Atrophy	10.6	18.3	2.1	0.5	329	186
Fissures	0	3.2	0	0	329	188
Swollen	47.1	31.6	10.0	8.0	329	187
Ankyloglossia	0.3	7.2	0	1.7	326	181
Gums						
Red or Very Red	1.8	21.4	—	—	329	187
Hypertrophy	75.2	50.0	18.6	22.3	161	94
Pigmentation—White	0	1.6	0	0	134	64
Pigmentation—Negro	7.7	13.8	0	0	26	29
Central Nervous System						
Moro Reflex	96.2	94.1	2.6	8.3	342	205
Abnormal Cry	5.9	7.1	0	0.5	341	197
Hyperactivity	2.2	0	0	0	324	179
Drowsiness	8.0	2.8	3.1	1.1	325	177
Skin						
Abnormal Hair Distribution—White	72.0	64.3	1.0	1.3	286	154
Abnormal Hair Distribution—Negro	42.9	55.4	0	0	56	56
Dehydration—White	25.3	23.7	9.0	8.6	277	139
Dehydration—Negro	52.7	35.3	21.8	19.6	55	51
Edema	1.2	4.3	0.3	0.5	327	186
Bleeding in Creases	6.2	15.6	0.6	1.1	325	186
Eruptions—White	7.7	18.2	0.3	0.7	286	148
Eruptions—Negro	1.8	9.1	0	0	56	55
Toxic Erythema—White	12.9	14.3	0.7	2.4	271	126
Toxic Erythema—Negro	1.9	6.5	0	2.2	54	46
Hives	5.0	4.2	1.2	1.1	161	9
Hemangioma—Lids—White	41.5	44.6	9.6	7.7	135	65
Hemangioma—Lids—Negro	26.9	24.1	3.8	0	26	29
Hemangioma—Forehead	13.7	16.3	3.7	0	161	92
Pilonidal Dimple	79.1	69.1	0.6	1.0	340	207
Jaundice—White	50.0	43.0	10.6	10.0	188	100
Jaundice—Negro	38.2	26.3	0	10.5	34	38

erate or severe occurrence is a better index of the level of these conditions in the Study population than is that of "any degree," but the analysis in this report will be based on the latter classification.

Table 3. Classification of conditions on newborn physical examination by estimated prevalence.

Site of Condition	Under 10.0 Per Cent	10.0 to 34.9 Per Cent	35.0 to 64.9 Per Cent	65.0 to 89.9 Per Cent	90.0 Per Cent and Over
Abdomen	Liver Palpable	Diastasis Recti—White and Negro			
	Lungs—Rales Lymph Nodes—Enlarged				
Genitalia	Undescended Testes Hydrocele Bleeding	Vaginal Discharge	Pigmentation—White	Hypertrophy	Pigmentation—Negro
				Breast Engorgement	
Skeleton	Congenital Dislocation of Hips Hyperextension of Knees			Rib Beading	Bowed Legs
Head	Overlapped Sutures—Negro	Moulding—White and Negro Overlapped Sutures—White		Open Sagittal Suture—White and Negro Open Posterior Fontanelle	
Eyes	Hemorrhage—Sclera—White	Discharge Hemorrhage—Sclera—Negro Circumcorneal Injection	Hyperemia—Sclera	Hyperemia—Lids	
Tongue	Fissures Ankyloglossia	Papillae Atrophy	Red or Purple Papillae Hypertrophy Swollen		
Gums	Red or Very Red Pigmentation—White	Pigmentation—Negro		Hypertrophy	
Central Nervous System	Abnormal Cry Hyperactivity Drowsiness				Moro Reflex
Skin	Edema Eruptions—White and Negro Toxic Erythema—Negro Hives	Dehydration—White Bleeding in Creases Toxic Erythema—White Hemangioma—Lids—White and Negro Hemangioma—Forehead Jaundice—White and Negro	Abnormal Hair Distribution—Negro Dehydration—Negro	Abnormal Hair Distribution—White	Pilonidal Dimple

The effect of the variations with time and by physician is to make difficult any exact estimate of the prevalence of most of these conditions in the Study population. However, it does seem feasible to classify the items into one of several groups based on broad ranges of prevalence (Table 3). For most conditions this classification is not difficult, although the prevalence of a few items is on the borderline between two groups and here the assignment has been rather arbitrary. Those conditions, such as bowed legs or jaundice, for which observed prevalence varied widely during the Study, have been classified on the basis of their occurrence during the latter portion of the program.

The greater number of the conditions investigated on the newborn physical examination are of relatively infrequent occurrence. The prevalence of over one-third of the items is under 10 per cent and is under 35 per cent for over one-half of them. Only four conditions were noted in over 90 per cent of the infants examined.

During the first days after birth, there is a progressive change in the rate of occurrence of some of these conditions. For those conditions for which the prevalence seemed to change during the first week of life, Table 4 gives the per cent of infants with a positive finding by the day after birth on which the examination was done. This table includes the results of a second examination which was done on an unselected group of infants and, hence, the total number of babies observed is higher than the corresponding numbers in the the preceding tables. A downward trend in prevalence during the first week of life seems to occur for those conditions which refer to the genitalia, head, and eyes. There is a decrease in the occurrence of atrophy of papillae and an increase in hypertrophy of papillae of the tongue. The skin conditions listed, with the exception of dehydration, show lowest prevalence during the first day of life followed by an increased and fairly constant prevalence after this time, a reflection of the commonly accepted fact that the skin undergoes change during the first days of life due to the drastic shift

Table 4. Prevalence of selected conditions on newborn physical examination by age at examination.

Condition	Case Number	Age at Examination (Days)							
		Per Cent with Condition in any Degree				Number of Infants Observed			
		Under 1	1–2	3–4	5 and Above	Under 1	1–2	3–4	5 and Above
Genitalia—Hypertrophy	Under 1,000	72.2	55.8	61.4	45.5	18	43	44	22
	1,000–1,599	72.5	64.0	62.2	57.5	102	211	201	80
	1,600 and Above	83.1	78.8	75.3	78.6	59	156	90	14
Genitalia—Pigmentation—White	Under 1,000	38.5	19.4	31.4	18.8	13	36	35	16
	1,000–1,599	22.8	38.1	29.9	25.0	79	168	147	56
	1,600 and Above	45.9	41.9	27.8	22.2	37	93	54	9
Genitalia—Vaginal Discharge	Under 1,000	28.3	38.0	16.2	19.5	53	92	68	41
	1,000–1,599	20.8	22.4	13.8	8.3	48	98	94	24
	1,600 and Above	17.9	24.4	15.4	14.3	28	78	39	7
Head—Moulding	Under 1,000	30.3	11.5	4.5	5.9	122	226	157	118
	1,000–1,599	29.4	7.8	5.7	2.6	102	205	194	76
	1,600 and Above	25.4	13.5	13.5	15.4	59	155	89	13
Head—Overlapped Sutures—White	Under 1,000	32.2	20.8	13.6	10.7	90	159	125	75
	1,000–1,599	32.1	13.1	9.0	1.8	78	168	145	55
	1,600 and Above	5.7	1.1	3.4	0	35	91	58	8
Eyes—Hyperemia—Lids	Under 1,000	90.9	84.0	73.9	59.0	110	206	161	100
	1,000–1,599	98.0	89.5	81.2	76.3	102	210	202	80
	1,600 and Above	94.9	91.0	83.3	78.6	59	155	90	14
Eyes—Hyperemia—Sclera	Under 1,000	70.6	39.5	32.5	23.8	17	38	40	21
	1,000–1,599	61.5	39.7	23.4	16.3	91	204	196	80
	1,600 and Above	67.9	35.1	19.8	16.7	53	148	91	12
Eyes—Discharge	Under 1,000	24.0	13.9	5.2	3.1	104	194	154	96
	1,000–1,599	28.0	12.3	6.6	8.9	100	204	198	79
	1,600 and Above	32.1	8.7	2.2	0	56	149	90	14

Tongue—Papillae Hypertrophy	Under 1,000	28.8	39.7	58.4	54.2	111	199	161	96
	1,000–1,599	44.1	52.9	59.8	55.0	102	210	199	80
	1,600 and Above	44.8	48.4	58.9	66.7	58	155	90	12
Tongue—Papillae Atrophy	Under 1,000	18.9	11.4	6.2	4.1	111	202	161	98
	1,000–1,599	17.6	11.4	5.0	5.0	102	211	201	80
	1,600 and Above	8.6	5.1	3.4	0	58	156	89	14
Gums—Pigmentation—Negro	Under 1,000	0	0	11.1	33.3	5	7	9	6
	1,000–1,599	4.3	11.6	16.7	12.5	23	43	54	24
	1,600 and Above	9.1	16.1	22.6	33.3	22	62	31	6
Skin—Abnormal Hair Distribution—Negro	Under 1,000	30.4	54.5	45.7	50.0	23	44	35	22
	1,000–1,599	43.5	64.3	75.9	66.7	23	42	54	24
	1,600 and Above	40.9	57.4	56.7	50.0	22	61	30	6
Skin—Dehydration—White	Under 1,000	34.1	24.7	16.7	5.3	91	166	132	76
	1,000–1,599	26.6	16.8	6.8	10.9	79	167	146	55
	1,600 and Above	30.8	43.6	23.3	14.3	39	94	60	7
Skin—Dehydration—Negro	Under 1,000	71.4	43.9	25.0	10.5	21	41	32	19
	1,000–1,599	47.8	51.2	22.6	0	23	43	53	24
	1,600 and Above	63.6	65.1	41.9	33.3	22	63	31	6
Skin—Bleeding in Creases	Under 1,000	1.8	11.1	12.7	13.5	109	199	158	89
	1,000–1,599	2.9	15.2	23.3	12.5	102	211	202	80
	1,600 and Above	3.4	20.5	24.4	14.3	59	156	90	14
Skin—Toxic Erythema—White	Under 1,000	8.1	19.5	16.9	18.3	86	154	124	71
	1,000–1,599	1.3	11.9	10.1	14.3	79	168	148	56
	1,600 and Above	5.4	16.3	5.2	0	37	92	58	8
Skin—Jaundice—White	Under 1,000	51.6	77.7	68.6	67.9	31	94	86	53
	1,000–1,599	10.4	31.7	32.2	27.8	77	167	146	54
	1,600 and Above	0	25.8	27.6	25.0	37	93	58	8

Table 5. Prevalence of conditions on physical examination at one month.

Condition	Per Cent with Condition								Number of Infants observed			
	Any Degree				Moderate or Severe							
	Total	Case Number			Total	Case Number			Total	Case Number		
		Under 1,000	1,000–1,599	1,600 and Above		Under 1,000	1,000–1,599	1,600 and Above		Under 1,000	1,000–1,599	1,600 and Above
Abdomen												
Liver Palpable	18.7	35.6	8.4	6.2	0.1	0.3	0	0	900	360	297	243
Spleen Palpable	0.6	1.4	0	0	0	0	0	0	898	358	297	243
Diastasis Recti—White	43.2	44.2	43.8	40.6	32.8	41.9	31.9	16.7	613	265	210	138
Diastasis Recti—Negro	62.1	57.7	59.1	67.6	61.4	56.3	59.1	66.7	264	71	88	105
Lungs—Rales	0.2	0	0.7	0	0	0	0	0	904	361	300	243
Lymph Nodes—Enlarged	17.8	22.2	13.0	17.3	6.4	6.6	4.7	8.2	908	365	300	243
Genitalia												
Hypertrophy—Male	67.9	58.7	72.5	65.7	46.7	34.8	51.0	46.0	336	46	153	137
Hypertrophy—Female	49.1	32.4	46.9	57.7	25.1	8.8	24.8	30.8	283	34	145	104
Pigmentation—White Male	29.4	16.2	41.0	20.9	6.6	2.7	9.5	4.7	228	37	105	86
Pigmentation—White Female	11.2	4.0	12.5	12.0	0	0	0	0	179	25	104	50
Pigmentation—Negro Male	89.7	80.0	89.6	91.8	81.3	60.0	83.3	83.7	107	10	48	49
Pigmentation—Negro Female	58.8	87.5	68.3	47.2	40.2	25.0	46.3	37.7	102	8	41	53
Meatal Ulcer	4.0	1.5	5.2	6.3	0.8	1.0	0.6	0.8	477	196	154	127
Undescended Testes	1.0	1.0	1.9	0	0	0	0	0	481	199	154	128
Vaginal Discharge	0.5	0.7	0.7	0	0	0	0	0	389	148	144	97
Hydrocele	9.0	8.6	11.7	6.3	0.2	0	0.6	0	480	198	154	128
Breast Engorgement	28.7	31.6	28.4	28.2	11.5	13.2	10.0	13.0	581	76	289	216
Skeleton												
Rib Beading—Male	51.0	40.8	58.8	57.2	11.8	11.4	10.5	13.8	492	201	153	138
Rib Beading—Female	42.9	33.1	48.6	50.5	7.7	10.8	7.5	2.9	417	166	146	105
Congenital Dislocation of Hips	0.4	0.6	0.3	0.4	0.1	0	0	0.4	896	357	300	239
Bowed Legs—Male	79.5	60.0	91.6	94.2	33.3	11.0	44.5	52.9	493	200	155	138
Bowed Legs—Female	73.9	52.4	87.7	88.6	23.0	7.2	28.8	40.0	417	166	146	105
Head												
Moulding	3.5	4.7	3.3	3.6	0.4	0.6	0.3	0.7	903	362	301	140
Open Sagittal Suture—White	35.9	36.5	44.6	21.2	9.1	9.4	8.9	8.8	616	266	213	137
Open Sagittal Suture—Negro	41.7	54.2	47.2	28.6	15.8	19.4	16.9	12.4	266	72	89	105
Open Posterior Fontanelle—White	34.1	31.1	46.0	21.9	12.7	11.2	16.0	10.9	636	286	213	137
Open Posterior Fontanelle—Negro	51.3	58.2	56.2	41.9	30.8	34.2	28.1	30.5	273	79	89	105
Eyes												
Hyperemia—Lids	5.4	2.7	6.4	7.9	1.0	0.3	1.0	2.1	872	333	299	240
Hyperemia—Sclera	2.6	3.7	2.0	2.9	0.6	1.2	0.7	0.4	617	81	296	240
Discharge	4.6	5.1	3.0	5.8	0.5	0	0.3	1.3	872	335	297	240
Hemorrhage—Sclera	0.6	1.2	0.3	0	0	0	0	0	870	333	298	239
Circumcorneal Injection	6.6	13.0	4.7	0	0.9	1.2	1.3	0	867	331	298	238

Tongue												
Red or Purple	20.0	28.1	13.9	16.1	—	—	—	—	882	338	302	242
Papillae Hypertrophy	48.0	36.7	58.5	50.6	18.5	11.7	27.4	16.7	870	332	299	239
Papillae Atrophy—White	15.3	14.7	15.5	16.2	3.7	1.9	4.8	5.1	602	259	207	136
Papillae Atrophy—Negro	22.7	21.7	21.2	24.8	6.3	2.9	2.4	11.9	255	69	85	101
Swollen—Male	47.2	31.7	52.9	61.3	12.8	2.2	22.6	16.1	475	183	155	137
Swollen—Female	58.1	36.4	63.4	81.9	14.7	5.3	20.7	20.0	401	151	145	105
Fissures	1.4	3.3	0.3	0	0	0	0	0	859	331	291	237
Gums												
Red or Very Red	4.1	4.5	3.6	4.1	—	—	—	—	877	333	302	242
Hypertrophy	79.0	79.3	79.9	77.6	41.4	56.1	46.8	29.5	618	82	299	237
Pigmentation—White	0.5	0	0	1.5	0	0	0	0	406	63	209	134
Pigmentation—Negro	37.4	42.1	46.1	29.1	15.2	21.1	20.2	9.7	211	19	89	103
Swollen	5.7	13.3	1.3	0.8	0.3	0.6	0.3	0	870	332	298	240
Teeth	0.4	1.2	0	0	0	0	0	0	455	166	126	163
Lips												
Fissures	15.1	38.3	1.0	0	2.5	6.2	0.3	0	876	337	297	242
Blisters	61.6	53.1	59.7	66.9	35.6	19.8	36.0	40.5	623	81	300	242
Swollen	2.4	5.3	0.3	0.9	0.2	0.6	0	0	870	337	300	233
Central Nervous System												
Moro Reflex	35.6	39.6	31.2	35.0	3.6	2.0	2.1	8.1	882	356	292	234
Hyperactivity	0.6	0.9	0	0.8	0	0	0	0	869	335	298	236
Skin												
Abnormal Hair Distribution—White	69.4	66.1	78.7	61.5	1.8	3.1	0.9	0	627	286	211	130
Abnormal Hair Distribution—Negro	54.9	55.8	63.6	47.9	0.8	2.6	0	0	261	77	88	96
Scaling	13.0	18.0	9.4	10.2	1.1	1.1	1.0	1.3	883	350	297	236
Eruptions—White	54.4	59.9	56.6	39.4	8.6	8.0	11.3	5.8	636	287	212	137
Eruptions—Negro	40.4	44.3	40.4	37.5	7.7	3.8	10.1	8.7	272	79	89	104
Cradle Cap	10.7	12.3	11.1	9.6	4.1	3.7	4.4	3.8	616	81	296	239
Hemangioma—Lids—White	30.7	36.9	28.4	31.3	7.9	12.3	7.2	6.7	407	65	208	134
Hemangioma—Lids—Negro	16.0	22.2	13.5	17.1	2.4	0	0	4.8	212	18	89	105
Hemangioma—Forehead	12.5	18.3	12.2	10.8	2.1	3.7	2.4	1.3	617	82	295	240
Diaper Rash—White	18.5	13.8	20.9	17.0	4.9	1.5	6.3	4.4	406	65	206	135
Diaper Rash—Negro	5.2	0	6.7	4.8	0.9	0	0	1.9	212	18	89	105

Table 6. Prevalence of conditions on physical examination at one month by examining physician and case number groups.

Condition	Per Cent with Condition								Number of Infants observed			
	Any Degree				Moderate or Severe							
	Under 1,300		1,300 and Above		Under 1,300		1,300 and Above		Under 1,300		1,300 and Above	
	Physician				Physician				Physician			
	A	B	A	B	A	B	A	B	A	B	A	B
Abdomen												
Liver Palpable	21.5	32.5	2.5	8.5	0	0.4	0	0	209	277	81	294
Spleen Palpable	0.5	1.4	0	0	0	0	0	0	208	276	81	294
Diastasis Recti—White	28.1	58.3	7.8	52.0	25.6	45.1	7.8	33.5	160	206	51	173
Diastasis Recti—Negro	28.9	75.4	23.3	76.0	28.9	73.8	23.3	76.0	38	65	30	121
Lungs—Rales	0	0	0	0.7	0	0	0	0	214	275	81	295
Lymph Nodes—Enlarged	18.1	20.9	2.5	18.6	3.3	9.4	0	8.1	215	277	81	296
Genitalia												
Hypertrophy—Male	64.6	75.0	74.4	63.2	25.0	55.6	41.0	50.3	48	72	39	163
Hypertrophy—Female	36.5	53.7	47.6	53.1	5.8	25.9	16.7	35.9	52	54	42	128
Pigmentation—White Male	45.9	27.8	46.2	17.6	13.5	1.9	11.5	3.9	37	54	26	102
Pigmentation—White Female	20.5	2.7	28.0	2.9	0	0	0	0	44	37	25	68
Pigmentation—Negro Male	90.0	94.4	92.9	89.8	80.0	83.3	85.7	83.1	10	18	14	59
Pigmentation—Negro Female	87.5	82.4	94.1	39.0	62.5	29.4	94.1	25.4	8	17	17	59
Meatal Ulcer	2.1	3.1	5.1	5.8	1.0	0.6	0	0.6	97	160	39	156
Undescended Testes	3.0	0.6	0	0	0	0	0	0	100	160	39	156
Vaginal Discharge	1.0	0.9	0	0	0	0	0	0	105	112	41	121
Hydrocele	10.1	9.4	15.4	6.4	0	0	2.6	0	99	160	39	156
Breast Engorgement	37.4	17.5	50.0	23.0	18.2	5.0	15.9	9.6	99	120	82	261
Skeleton												
Rib Beading—Male	55.4	41.0	55.3	61.8	12.9	11.2	2.6	14.5	101	161	38	165
Rib Beading—Female	47.0	31.9	54.8	48.5	13.7	6.9	4.8	4.6	117	116	42	130
Congenital Dislocation of Hips	0.9	0	1.2	0.3	0	0	0	0.3	212	274	81	292
Bowed Legs—Male	71.3	70.0	90.0	93.3	24.8	16.9	62.5	49.7	101	160	40	165
Bowed Legs—Female	69.2	54.3	97.6	91.5	16.2	9.5	57.1	30.8	117	116	42	130
Head												
Moulding	5.6	2.9	8.6	1.4	0	0.7	1.2	0.3	215	275	81	294
Open Sagittal Suture—White	76.7	13.7	70.6	13.1	16.6	3.9	17.6	6.3	163	205	51	175
Open Sagittal Suture—Negro	87.2	21.5	90.3	25.6	33.3	7.7	29.0	11.6	39	65	31	121
Open Posterior Fontanelle—White	57.6	21.2	68.6	16.0	14.7	11.5	19.6	10.3	177	208	51	175
Open Posterior Fontanelle—Negro	70.7	44.1	87.1	40.5	31.7	29.4	16.1	33.9	41	68	31	121
Eyes												
Hyperemia—Lids	7.0	0.8	30.5	1.4	0.5	0.4	6.1	0.7	199	266	82	293
Hyperemia—Sclera	3.0	0.8	8.5	0.7	1.0	0.8	1.2	0.3	100	124	82	291
Discharge	2.0	6.7	0	5.5	0	0.4	0	1.0	198	268	81	293
Hemorrhage—Sclera	1.5	0.7	0	0	0	0	0	0	197	268	82	292
Circumcorneal Injection	2.6	15.7	2.4	2.4	0	1.5	1.2	0.7	196	267	82	291

Tongue												
Red or Purple	17.8	28.5	8.5	17.6	—	—	—	—	202	270	82	295
Papillae Hypertrophy	37.4	48.3	51.2	54.1	12.6	19.5	17.1	22.9	198	267	82	292
Papillae Atrophy—White	11.6	16.8	3.9	21.1	1.9	3.0	0	7.6	155	202	51	171
Papillae Atrophy—Negro	13.5	23.8	10.0	29.1	0	3.2	3.3	10.3	37	63	30	117
Swollen—Male	48.9	27.1	50.0	63.0	11.7	5.2	15.0	20.6	94	155	40	165
Swollen—Female	50.5	36.0	73.8	80.6	13.3	7.9	26.2	19.4	105	114	42	129
Fissures	4.1	1.5	0	0	0	0	0	0	194	267	81	285
Gums												
Red or Very Red	0	7.5	0	5.4	—	—	—	—	201	266	82	295
Hypertrophy	92.2	72.2	96.3	72.3	59.8	46.0	44.4	33.2	102	126	81	289
Pigmentation—White	0	0	2.0	0	0	0	0	0	83	91	49	169
Pigmentation—Negro	52.6	40.0	51.6	30.0	26.3	20.0	16.1	11.7	19	35	31	120
Swollen	19.5	2.6	0	1.4	0.5	0.4	0	0.3	200	266	82	291
Teeth	1.1	0	0	0	0	0	0	0	181	32	75	136
Lips												
Fissures	22.4	31.3	0	0.7	1.0	7.1	0	0.3	201	268	79	296
Blisters	58.4	54.8	58.5	68.4	30.7	28.6	30.5	43.5	101	126	82	294
Swollen	5.4	1.5	1.2	0	0.5	0.4	0	0	202	269	82	285
Central Nervous System												
Moro Reflex	12.1	60.2	30.5	34.0	0	3.8	0	7.7	215	264	82	285
Hyperactivity	1.0	0	1.2	0.3	0	0	0	0	202	266	81	289
Skin												
Abnormal Hair Distribution—White	67.6	71.2	84.3	66.5	0.6	4.8	0	0	176	208	51	164
Abnormal Hair Distribution—Negro	33.3	75.0	61.3	53.1	0	2.9	0	0	39	68	31	113
Scaling	14.1	19.6	3.7	10.0	1.0	1.1	2.5	0.7	206	271	81	290
Eruptions—White	51.4	61.1	60.8	49.1	5.6	10.1	29.4	4.6	177	208	51	173
Eruptions—Negro	39.0	47.1	35.5	39.7	4.9	7.4	6.5	9.9	41	68	31	121
Cradle Cap	11.9	8.8	13.6	10.7	2.0	3.2	4.9	5.2	101	125	81	289
Hemangioma—Lids—White	33.7	25.8	29.4	32.9	8.4	6.5	11.8	7.8	83	93	51	167
Hemangioma—Lids—Negro	16.7	8.6	16.1	19.0	0	0	3.2	3.3	18	35	31	121
Hemangioma—Forehead	18.8	11.0	8.8	12.8	5.9	1.6	1.3	1.4	101	127	80	289
Diaper Rash—White	20.7	17.4	24.0	16.0	6.1	4.3	6.0	4.7	82	92	50	169
Diaper Rash—Negro	11.1	2.9	3.2	5.0	0	0	3.2	0.8	18	35	31	121

from the ante to the post-natal environment. Most of the other changes in prevalence during the first week of life are also of the type which would be expected. It should be noted that these trends are not always uniform over all three case number groups and that the percentages are sometimes based on a small number of observations.

Results of the Physical Examinations at One Month

The prevalence of each condition on the examination of the infants at approximately one month of age is shown in Table 5. Omitted from this table are three conditions which were observed in none of the infants, hyperextension of knees, craniotabes, and drowsiness, and two conditions which were each observed in only one infant, masses in abdomen and pharyngeal infection.

The differences by race at one month are similar to those noted on the birth examination. A higher prevalence was found among the white infants for certain skin conditions, abnormal hair distribution, eruptions, hemangioma of the lids, and diaper rash, while a more frequent occurrence was noted among Negro babies for diastasis recti, genital pigmentation, open sagittal suture, open posterior fontanelle, atrophy of papillae, and gum pigmentation. In addition, some differences by sex which were not observed at birth were found at one month. The prevalence was higher among males for genital hypertrophy, genital pigmentation, rib beading, and bowed legs, and it was lower among males for swollen tongue. The differences by sex in the two genital conditions may be expected, but the other differences are most likely the occasional random difference which appears to be of statistical significance.

The apparent change in prevalence for some conditions during the course of the Study which was noted in the results of the newborn examinations, is also present in these results (Table 5) as are the differences between the examining physicians in the relative number of infants observed with certain conditions. The prevalence of each condition by examining

physician is given in Table 6, and the differences between the physicians are of much the same magnitude as those found for the newborn examination. To gain comparability with Table 2, only two case number groups are used in this table, above and below number 1,300.

The classification of the conditions at one month into broad categories of prevalence is shown in Table 7. The most frequent prevalence is under 10 per cent, as was found for the results at birth, but a relatively larger number of items fell in the 35 to 64.9 per cent range at one month than at birth, and at one month only one condition was observed in over 90 per cent of the infants. An estimate of the change in prevalence during the first month of life of the conditions observed on both examinations is afforded by Table 8, which is a cross-classification of Tables 3 and 7. The prevalence of most items either remained about the same or decreased during this one-month period. An increase in prevalence between the two examinations is found for enlarged lymph nodes, diastasis recti, pigmentation of the gums in Negroes, swollen tongue in females, and skin eruptions, but the change in the first two items, enlarged lymph nodes and diastasis recti, may be attributed primarily to the differences in the observations of the examining pediatricians. Of the conditions which showed the most marked decreases in prevalence, hyperemia of the lids and sclera, breast engorgement, open posterior fontanelle in white infants, genital pigmentation in Negro females, and Moro reflex, only the changes in hyperemia of the lids and sclera and Moro reflex appear to be real changes, relatively unaffected by differences in the readings of the two physicians.

The Influence of the Nutritional Supplements

In this Study the evaluation of the effect of the nutritional supplements taken by the mother during pregnancy upon the physical status of her infant has utilized two approaches. The first, presented in an earlier paper in this series, was in terms of the infant's size at birth and his growth during the subsequent

Table 7. Classification of conditions on physica lexamination at one month by estimated prevalence.

Site of Condition	Under 10.0 Per Cent	10.0 to 34.9 Per Cent	35.0 to 64.9 Per Cent	65.0 to 89.9 Per Cent	90.0 Per Cent and Over
Abdomen	Liver Palpable Spleen Palpable		Diastasis Recti—White and Negro		
	Lungs—Rales	Lymph Nodes—Enlarged			
Genitalia	Meatal Ulcer Undescended Testes Vaginal Discharge Hydrocele	Pigmentation—White Male and Female	Hypertrophy—Female Pigmentation—Negro Female	Hypertrophy—Male Pigmentation—Negro Male	
		Breast Engorgement			
Skeleton	Congenital Dislocation of Hips		Rib Beading—Male and Female	Bowed Legs—Female	Bowed Legs—Male
Head	Moulding	Open Posterior Fontanelle—White	Open Sagittal Suture—White and Negro Open Posterior Fontanelle—Negro		
Eyes	Hyperemia—Lids Hyperemia—Sclera Discharge Hemorrhage—Sclera Circumcorneal Injection				
Tongue	Fissures	Red or Purple Papillae Atrophy—White and Negro	Papillae Hypertrophy Swollen—Male	Swollen—Female	
Gums	Red or Very Red Pigmentation—White Swollen Teeth		Pigmentation—Negro	Hypertrophy	
Lips	Fissures Swollen		Blisters		
Central Nervous System	Hyperactivity		Moro Reflex		
Skin	Diaper Rash—Negro	Scaling Cradle Cap Hemangioma—Lids—White and Negro Hemangioma—Forehead Diaper Rash—White	Abnormal Hair Distribution—Negro Eruptions—White and Negro	Abnormal Hair Distribution—White	

Table 8. Classification of conditions on physical examination at birth and one month by estimated prevalence.

Prevalence on Examination at One Month	Prevalence on Newborn Examination				
	Under 10.0 Per Cent	10.0 to 34.9 Per Cent	35.0 to 64.9 Per Cent	65.0 to 89.9 Per Cent	90.0 Per Cent and Over
Under 10.0 Per Cent	Liver Palpable Spleen Palpable Lungs—Rales Undescended Testes Hydrocele Congenital Dislocation of Hips Hyperextension of Knees Hemorrhage—Sclera—White Tongue—Fissures Gums—Red or Very Red Gums—Pigmentation—White Hyperactivity Drowsiness	Vaginal Discharge Head—Moulding—White and Negro Eyes—Discharge Hemorrhage—Sclera—Negro Circumcorneal Injection	Hyperemia—Sclera	Hyperemia—Lids	
10.0 to 34.9 Per Cent	Lymph Nodes—Enlarged	Papillae Atrophy—White and Negro Hemangioma—Lids—White and Negro Hemangioma—Forehead	Genitalia—Pigmentation—White Male and Female Tongue—Red or Purple	Breast Engorgement Open Posterior Fontanelle—White	
35.0 to 64.9 Per Cent	Eruptions—White and Negro	Diastasis Recti—White and Negro Gums—Pigmentation—Negro	Papillae Hypertrophy Tongue—Swollen—Male Abnormal Hair Distribution—Negro	Genitalia—Hypertrophy—Female Rib Beading—Male and Female Open Sagittal Suture—White and Negro Open Posterior Fontanelle—Negro	Genitalia—Pigmentation—Negro Female Moro Reflex
65.0 to 89.9 Per Cent			Tongue—Swollen—Female	Genitalia—Hypertrophy—Male Gums—Hypertrophy Abnormal Hair Distribution—White	Genitalia—Pigmentation—Negro Male Bowed Legs—Female
90.0 Per Cent and Over					Bowed Legs—Male

Table 9. Comparison of the prevalence of selected conditions in the "vitamin" and "no vitamin" groups on newborn physical examination.

Condition	Case Number	Per Cent with Condition in any Degree						Number of Infants Observed					
		Total		Without Protein		With Protein		Total		Without Protein		With Protein	
		No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins
Genitalia—Hypertrophy	Under 1,000	45.9	66.7	60.9	57.1	21.4	75.0	37	30	23	14	14	16
	1,000–1,599	61.0	68.2	55.1	70.4	72.1	65.7	195	151	127	81	68	70
	1,600 and Over	78.0	80.2	82.1	84.7	67.7	73.0	109	96	78	59	31	37
	Total	64.8	72.2	64.9	74.7	64.6	69.1	341	277	228	154	113	123
	Probability	.05–.10		.05–.10		.40–.50							
Breast Engorgement	Under 1,000	43.2	63.3	52.2	64.3	28.6	62.5	37	30	23	14	14	16
	1,000–1,599	67.5	74.5	67.5	81.5	67.6	66.2	194	149	126	81	68	68
	1,600 and Over	68.5	76.0	69.2	78.0	66.7	73.0	108	96	78	59	30	37
	Total	65.2	73.8	66.5	78.6	62.5	67.8	339	275	227	154	112	121
	Probability	.02–.05		.01–.02		.40–.50							
Gums—Pigmentation—Negro	Under 1,000	25.0	0	40.0	0	0	0	8	8	5	4	3	4
	1,000–1,599	13.0	5.7	16.7	5.3	6.2	6.2	46	35	30	19	16	16
	1,600 and Over	24.4	12.9	20.0	16.7	36.4	7.7	41	31	30	18	11	13
	Total	18.9	8.1	20.0	9.8	16.7	6.1	95	74	65	41	30	33
	Probability	.02–.05		.10–.20		.10–.20							
Gums—Red or Purple	Under 1,000	15.6	6.6	14.1	4.0	18.8	11.5	147	152	99	100	48	52
	1,000–1,599	4.6	3.3	3.9	3.7	5.9	2.9	195	151	127	81	68	70
	1,600 and Over	3.7	3.1	3.9	3.4	3.2	2.7	108	96	77	59	31	37
	Total	8.0	4.5	7.3	3.8	9.5	5.7	450	399	303	240	147	159
	Probability	.01–.02		.02–.05		.10–.20							
Skin—Eruptions—White	Under 1,000	16.5	7.9	17.6	8.5	14.3	6.7	127	127	85	82	42	45
	1,000–1,599	6.0	3.4	6.2	3.2	5.8	3.7	149	116	97	62	52	54
	1,600 and Over	3.0	1.5	2.1	2.4	5.0	0	67	65	47	41	20	24
	Total	9.3	4.9	9.6	5.4	8.8	4.1	343	308	229	185	114	123
	Probability	.01–.02		.05–.10		.10–.20							

three months. The second approach is by comparison of the prevalence of the various conditions among the groups of infants classified according to the nutritional supplement taken by the mother.

To estimate the effect of the vitamins and of the protein supplement the following comparisons of prevalence rates were made for each condition for each examination and each case number group:[8]

Effect of vitamins:

1. Control and "protein only" groups vs. "vitamin only" and "protein and vitamin" groups.
2. Control group vs. "vitamin only" group.
3. "Protein only" group vs. "protein and vitamin" group.

Effect of protein supplement:

1. Control and "vitamin only" groups vs. "protein only" and "protein and vitamin" groups.
2. Control group vs. "protein only" group.
3. "Vitamin only" group vs. "protein and vitamin" group.

Each of these comparisons for each condition consisted of three pairs of percentages of occurrence, one for each case number group, and the series of three differences between the pairs was tested for statistical significance.[9]

The conditions which seemed to be influenced at birth by the vitamins taken by the mother are shown in Table 9 and those

[8] Excluded from these comparisons are the babies of mothers who were given the protein supplement but took less than a total of 20 lbs. compared with a scheduled maximum of 45 to 50 lbs.

[9] This test followed a procedure given by Cochran (3). The sum of the weighted differences in the proportions (percentages) was computed, divided by its standard error, and the result referred to a table of the normal distribution. Algebraically, the procedure was

$$\frac{\bar{d}}{S.E.} = \frac{\Sigma w_i d_i}{\sqrt{\Sigma w_i \hat{p}_i \hat{q}_i}}$$

where

p_{i1} and p_{i2} = the proportions for the i^{th} comparison

$$d_i = p_{i1} - p_{i2}$$

$$w_i = \frac{n_{i1} n_{i2}}{n_{i1} + n_{i2}}$$

(Continued on page 345)

Table 10. Comparison of the prevalence of selected conditions in the "protein" and "no protein" groups on newborn physical examination.

Condition	Case Number	Per Cent with Condition in any Degree						Number of Infants Observed					
		Total		Without Vitamins		With Vitamins		Total		Without Vitamins		With Vitamins	
		No Protein	Protein	No Protein	Protein	No Protein	Protein	No Protein	Protein	No Protein	Protein	No Protein	Protein
Genitalia—Pigmentation —White	Under 1,000	21.4	17.4	27.8	27.3	10.0	8.3	28	23	18	11	10	12
	1,000–1,599	32.1	30.2	28.9	25.0	37.1	35.2	159	106	97	52	62	54
	1,600 and Over	51.7	27.3	54.2	35.0	48.8	20.8	89	44	48	20	41	24
	Total	37.3	27.7	36.2	27.7	38.9	27.8	276	173	163	83	112	90
	Probability	.05–.10		.20–.30		.10–.20							
Papillae Hypertrophy	Under 1,000	36.7	40.4	40.2	54.2	33.3	27.5	196	99	97	48	99	51
	1,000–1,599	45.9	61.3	46.0	65.7	45.7	57.1	207	137	126	67	81	70
	1,600 and Over	54.4	50.7	46.8	48.4	64.4	52.8	136	67	77	31	59	36
	Total	44.7	52.2	44.3	58.2	45.2	46.5	539	303	300	146	239	157
	Probability	.05–.10		<.01		>.90							
Toxic Erythema—White	Under 1,000	11.7	22.0	11.8	31.6	11.6	13.6	145	82	76	38	69	44
	1,000–1,599	8.8	8.5	8.2	13.5	9.7	3.7	159	106	97	52	62	54
	1,600 and Over	6.8	20.9	8.5	15.8	4.9	25.0	88	43	47	19	41	24
	Total	9.4	15.6	9.5	20.2	9.3	11.5	392	231	220	109	172	122
	Probability	.01–.02		<.01		.40–.50							

affected by the protein supplement in Table 10, while the total occurrence in each supplement group of each condition is given in Appendix Table 1. The striking point about these tables is how few conditions, many of which were included on the physical examinations on the advice of the advisory group, because they were believed to be related to the nutritional status of the mother or child, seem to be influenced by the nutritional supplements.

Five conditions seem to be related to some degree at birth with the taking of vitamins by the mother during pregnancy. If the entire "vitamin" group is compared with the "no vitamin" group, regardless of whether the mother received the protein supplement, it is found that breast engorgement and genital hypertrophy are more frequent in the "vitamin" group and red or purple gums, skin eruptions in white babies, and gum pigmentation in Negro babies, are less frequent. The differences in prevalence of genital hypertrophy are not quite at the level of statistical significance. The comparisons between the "vitamin" and "no vitamin" groups of babies also considering whether or not the mother received the protein supplement show that the differences in prevalence for four of these five conditions are statistically significant or approach this level when the mother did not take the supplement, while the differences are not significant when the protein was taken. However, the pattern of differences for red and purple gums, skin eruption in white babies, and possibly gum pigmentation in Negro babies, among the groups with protein are in the same direction as in the groups without protein, and the failure to reach a statistically significant level may be due primarily to the smaller number of infants in the protein supplemented groups.

The protein supplement appears to affect only three condi-

n_{i1} and n_{i2} = the number of observation on which p_{i1} and p_{i2} are based

$$\hat{p}_i = \frac{n_{i1}\,p_{i1} + n_{i2}\,p_{i2}}{n_{i1} + n_{i2}}$$

$$\hat{q}_i = 1 - \hat{p}_i$$

Statistical significance in this paper implies $P \leq .05$.

Table 11. Comparison of the prevalence of selected conditions in the "vitamin" and "no vitamin" groups on physical examination at one month.

Condition	Case Number	Per Cent with Condition in any Degree						Number of Infants Observed					
		Total		Without Protein		With Protein		Total		Without Protein		With Protein	
		No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins	No Vitamins	Vitamins
Hyperemia—Sclera	Under 1,000	2.5	5.6	4.0	5.6	0	5.6	40	36	25	18	15	18
	1,000–1,599	0.6	3.4	1.1	1.6	0	5.5	154	119	90	64	64	55
	1,600 and Over	1.8	4.7	1.2	3.9	3.3	5.7	112	86	82	51	30	35
	Total	1.3	4.1	1.5	3.0	0.9	5.6	306	241	197	133	109	108
	Probability	.02–.05		.30–.40		.05–.10							
Gums—Pigmentation—Negro	Under 1,000	45.5	37.5	50.0	50.0	33.3	25.0	11	8	8	4	3	4
	1,000–1,599	58.1	28.6	65.4	30.0	47.1	26.7	43	35	26	20	17	15
	1,600 and Over	26.5	22.6	32.4	10.0	8.3	45.5	49	31	37	20	12	11
	Total	41.7	27.0	46.5	22.7	31.3	33.3	103	74	71	44	32	30
	Probability	.02–.05		<.01		.80–.90							

Table 12. Comparison of the prevalence of selected conditions in the "protein" and "no protein" groups on physical examination at one month.

Condition	Number	Per Cent with Condition in any Degree						Number of Infants Observed					
		Total		Without Vitamins		With Vitamins		Total		Without Vitamins		With Vitamins	
		No Protein	Protein	No Protein	Protein	No Protein	Protein	No Protein	Protein	No Protein	Protein	No Protein	Protein
Rib Beading—Female	Under 1,000	28.7	41.9	25.9	35.0	31.5	47.8	108	43	54	20	54	23
	1,000–1,599	40.3	61.4	42.6	66.7	36.7	55.6	77	57	47	30	30	27
	1,600 and Over	48.5	54.5	53.2	53.8	38.1	55.6	68	22	47	13	21	9
	Total	37.5	53.3	39.9	54.0	34.3	52.5	253	122	148	63	105	59
	Probability	<.01		.05–.10		.02–.05							
Gums—Swollen	Under 1,000	15.3	7.4	17.2	6.5	13.6	8.2	202	95	99	46	103	49
	1,000–1,599	2.6	0	3.3	0	1.6	0	154	121	90	65	64	56
	1,600 and Over	1.5	0	0	0	3.8	0	134	65	82	29	52	36
	Total	7.6	2.5	7.4	2.1	7.8	2.8	490	281	271	140	219	141
	Probability	.01–.02		.02–.05		.10–.20							
Gums—Hypertrophy	Under 1,000	72.7	87.9	76.9	80.0	66.7	94.4	44	33	26	15	18	18
	1,000–1,599	79.4	80.2	78.0	84.8	81.3	74.5	155	121	91	66	64	55
	1,600 and Over	72.2	85.5	71.6	85.2	73.1	85.7	133	62	81	27	52	35
	Total	75.6	82.9	75.3	84.3	76.1	81.5	332	216	198	108	134	108
	Probability	.05–.10		.05–.10		.30–.40							

tions at birth. In the comparison of the total "no protein" group with the "protein" group, toxic erythema in white babies and papillae hypertrophy are more frequent among the latter group of infants and genital pigmentation in white babies is less frequent. The differences for these last two conditions are not quite significant. In the comparison for the effect of the protein supplement, taking into account the presence or absence of vitamins in the mother's supplement, the greater prevalence in the "protein" group of toxic erythema and papillae hypertrophy is highly significant when no vitamins were taken, while for none of these conditions were there significant differences between the "protein" and "no protein" groups when the mother also received vitamins. The differences with respect to toxic erythema may be indicative of minor allergic tendencies in the mothers receiving the protein supplement.

These few conditions which seem to be influenced by the nutritional supplements refer primarily to the tongue, skin, or genitalia. It should be noted that for some conditions the effect of either the protein or vitamins seems to occur only in the absence of the other supplement and that although one of the supplements may appear to influence the occurrence of a condition, its presence or absence accounts for only a portion of the total prevalence of that condition.

On the examinations at one month two conditions appear to be affected by the vitamin supplement (Table 11) and three by the protein supplement (Table 12). The prevalence of all conditions on the one-month examination by study group is given in Appendix Table 2. Hyperemia of the sclera is more prevalent among babies in the "vitamin" group and gum pigmentation in Negro babies is less prevalent. The latter condition is the only one which seemed to be related to either supplement at both birth and one month of age. For hyperemia of the sclera the greater differences between the "vitamin" and the "no vitamin" groups are found when the mother also received the protein supplement, while for gum pigmentation the differences are significant only in the absence of the protein.

The protein supplement is related to an increased prevalence of rib beading among female infants at one month of age, regardless of whether the mother also took vitamins. It should be noted with respect to this observation that the protein supplement contained calcium. This supplement is also associated with a significantly lower frequency of swollen gums and a higher prevalence of gum hypertrophy which is on the borderline of statistical significance.

In an earlier paper in this series, it was concluded that the nutritional supplements taken by the mother had little effect upon the physical status of her infant as measured by size at birth and growth during the next three months. The material presented above leads to a similar conclusion, that the nutritional supplements have only a minor influence upon the occurrence of those conditions included in the physical examinations at birth and one month of age. Although for a few conditions variation in prevalence is associated with the nutritional supplements, the number of such conditions is relatively small, and the magnitude of the variations, though statistically significant, is in most cases not great. It is possible that association between the supplements and some conditions has been obscured by the changes in prevalence during the program noted for certain conditions and by the differences between the physicians in the relative frequency with which some conditions were observed. On the other hand, in a series of tests for statistical significance, such as was done here, about 5 per cent may be expected to appear to be significant when the differences are really due only to chance variation. In a population with more overt evidence of nutritional deficiency the observed differences would probably have been greater. Even so, the changes noted could be interpreted as indicating that minor degrees of deficiency exist in at least some mothers in the control population.

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Appendix Table 1. Prevalence of conditions on newborn physical examination in each nutrient supplement group.

Condition	Per Cent with Condition								Number of Infants Observed			
	Any Degree				Moderate or Severe							
	Control	Vitamins Only	Protein Only	Vitamins and Protein	Control	Vitamins Only	Protein Only	Vitamins and Protein	Control	Vitamins Only	Protein Only	Vitamins and Protein
Abdomen												
Liver Palpable	4.2	4.4	2.6	2.4	0	0	0	0	312	252	151	164
Diastasis Recti—White	24.6	26.3	24.1	20.5	21.0	20.1	20.5	16.4	224	179	112	122
Diastasis Recti—Negro	31.3	19.7	37.1	36.8	23.8	16.4	20.0	28.9	80	61	35	38
Lungs—Rales	0.3	0.4	0.7	0	0	0	0	0	296	232	139	156
Lymph Nodes—Enlarged	0.3	0.8	0.7	1.2	0	0	0.7	0	311	249	150	161
Genitalia												
Hypertrophy	64.9	74.7	64.6	69.1	36.4	40.9	31.0	43.9	228	154	113	123
Pigmentation—White	36.2	38.9	27.7	27.8	8.0	6.2	6.0	2.2	163	113	83	90
Pigmentation—Negro	96.9	100.0	93.3	97.0	92.3	90.2	90.0	81.8	65	41	30	33
Undescended Testes	2.5	2.2	6.9	0	0	0	0	0	159	137	87	92
Vaginal Discharge	24.0	27.5	16.4	20.6	4.7	2.8	1.6	4.4	150	109	61	68
Hydrocele	2.5	2.9	3.4	2.2	0.6	0	0	0	160	137	88	92
Bleeding	0.7	0	0	1.5	0	0	0	0	149	109	61	67
Breast Engorgement	66.5	78.6	62.5	67.8	21.6	21.4	16.1	18.2	227	154	112	121
Skeleton												
Rib Beading	68.8	69.7	72.8	76.2	19.7	22.3	25.2	17.7	314	251	151	164
Congenital Dislocation of Hips	0	0.4	0.7	0.6	0	0	0	0	313	250	151	163
Bowed Legs	78.7	70.8	80.1	76.2	33.1	32.0	37.1	34.8	314	250	151	164
Hyperextension of Knees	0.3	0.4	0	2.5	0	0	0	0	303	238	145	160
Head												
Moulding—White	19.1	12.4	8.0	15.4	5.2	0	2.7	4.1	230	185	113	123
Moulding—Negro	22.5	17.7	25.0	10.8	11.3	8.1	2.8	2.7	80	62	36	37
Overlapped Sutures—White	19.6	14.0	20.5	16.7	1.4	0	1.8	0.8	219	178	112	120
Overlapped Sutures—Negro	11.3	13.3	8.6	5.4	0	0	0	0	80	60	35	37
Open Sagittal Suture—White	79.8	85.5	81.3	78.7	38.1	41.3	42.9	38.5	223	179	112	122
Open Sagittal Suture—Negro	83.8	93.3	91.4	84.2	50.0	38.3	40.0	44.7	80	60	35	38
Open Posterior Fontanelle	79.2	84.5	79.5	77.3	31.9	31.5	30.5	35.6	313	251	151	163
Eyes												
Hyperemia—Lids	91.5	84.9	89.7	89.9	59.0	47.5	53.4	52.2	305	238	146	159
Hyperemia—Sclera	49.1	38.9	37.3	40.2	7.9	4.9	6.4	12.0	214	144	110	117
Discharge	18.2	13.7	10.3	15.5	4.8	3.1	1.4	7.7	291	227	145	155
Hemorrhage—Sclera—White	8.1	7.5	4.7	8.7	1.5	0.6	0.9	0	197	160	106	104
Hemorrhage—Sclera—Negro	11.1	14.8	16.1	11.8	1.4	1.9	3.2	0	72	54	31	34
Circumcorneal Injection	12.9	5.7	13.3	13.9	0.4	1.4	0	2.2	263	209	135	137

Tongue												
Red or Purple	52.3	50.0	49.0	55.6	—	—	—	—	304	240	147	160
Papillae Hypertrophy	44.3	45.2	58.2	46.5	16.0	11.7	21.2	18.5	300	239	146	157
Papillae Atrophy	11.2	11.8	6.2	11.3	1.3	1.3	0	1.9	303	237	146	160
Fissures	0.7	1.3	0.7	0.6	0	0	0	0	303	239	147	160
Swollen	43.2	43.3	49.0	47.5	10.6	11.3	15.0	12.5	303	240	147	160
Ankyloglossia	2.7	2.5	2.1	1.9	0.7	0.8	0	0	297	238	143	159
Gums												
Red or Very Red	7.3	3.8	9.5	5.7	—	—	—	—	303	240	147	159
Hypertrophy	75.4	74.7	78.8	68.0	21.1	16.2	19.5	18.9	228	154	113	122
Pigmentation—White	0.6	0	0	1.1	0	0	0	0	161	112	81	90
Pigmentation—Negro	20.0	9.8	16.7	6.1	1.5	0	3.3	3.0	65	41	30	33
Central Nervous System												
Moro Reflex	96.2	95.2	96.6	97.5	3.5	2.8	2.1	2.5	314	252	146	161
Abnormal Cry	4.5	5.7	4.8	3.1	0	0.4	0	0	310	247	147	160
Hyperactivity	1.0	1.3	2.1	2.6	0	0	0.7	0	300	239	142	155
Drowsiness	3.0	5.0	5.0	2.6	1.0	2.1	2.1	1.3	300	239	141	154
Skin												
Abnormal Hair Distribution—White	75.8	70.8	79.6	79.8	1.3	0.5	0.9	0.8	231	185	113	124
Abnormal Hair Distribution—Negro	58.8	51.6	61.8	65.8	0	0	0	0	80	64	34	38
Dehydration—White	24.4	31.7	23.2	23.6	8.9	9.4	4.5	5.7	225	180	112	123
Dehydration—Negro	53.8	50.8	48.6	36.8	25.0	26.2	25.7	18.4	80	61	35	38
Edema	2.3	1.7	2.0	1.3	0.3	0	0	0.6	302	238	147	160
Bleeding in Creases	11.9	12.7	10.2	12.5	1.3	1.7	1.4	2.5	302	237	147	160
Eruptions—White	9.6	5.4	8.8	4.1	0.4	0.5	0.9	0	229	185	114	123
Eruptions—Negro	1.2	4.8	5.6	5.1	0	0	0	0	81	63	36	39
Toxic Erythema—White	9.5	9.3	20.2	11.5	1.8	0.6	1.8	1.6	220	172	109	122
Toxic Erythema—Negro	5.1	0	11.8	5.3	1.3	0	5.9	0	79	58	34	38
Hives	2.2	1.9	1.8	4.1	0	0.6	0.9	0.8	226	154	112	123
Hemangioma—Lids—White	30.7	30.4	28.0	34.4	3.7	3.6	4.9	10.0	163	112	82	90
Hemangioma—Lids—Negro	23.1	19.5	16.7	18.2	4.6	0	3.3	3.0	65	41	30	33
Hemangioma—Forehead	9.7	9.7	12.8	6.5	1.8	1.3	3.7	1.6	226	154	109	123
Pilonidal Dimple	85.2	79.0	88.1	87.7	1.0	0.8	0.7	1.2	311	248	151	163
Jaundice—White	29.6	41.1	37.1	36.6	3.8	9.2	11.2	8.9	186	141	89	101
Jaundice—Negro	16.2	23.4	33.3	20.0	2.9	4.3	9.1	0	68	47	33	35

Appendix Table 2. Prevalence of conditions on physical examination at one month in each nutrient supplement group.

Condition	Per Cent with Condition								Number of Infants Observed			
	Any Degree				Moderate or Severe							
	Control	Vitamins Only	Protein Only	Vitamins and Protein	Control	Vitamins Only	Protein Only	Vitamins and Protein	Control	Vitamins Only	Protein Only	Vitamins and Protein
Abdomen												
Liver Palpable	17.0	22.4	17.8	19.0	0	0.4	0	0	283	228	146	142
Spleen Palpable	0	2.2	0	0	0	0	0	0	283	227	145	142
Diastasis Recti—White	39.3	42.3	49.0	45.7	38.7	39.7	48.1	43.8	191	156	104	105
Diastasis Recti—Negro	64.3	62.9	74.4	62.2	61.9	62.9	74.4	62.2	84	62	39	37
Lungs—Rales	0.4	0	0.7	0	0	0	0	0	282	229	146	146
Lymph Nodes—Enlarged	15.5	18.6	17.7	16.4	4.2	5.2	9.5	7.5	283	231	147	146
Genitalia												
Hypertrophy—Male	68.8	68.5	67.2	65.2	48.4	42.5	48.4	39.4	93	73	64	66
Hypertrophy—Female	47.1	50.8	52.2	48.8	20.2	34.4	30.4	20.9	104	61	46	43
Pigmentation—White—Male	27.7	36.0	34.8	17.4	6.2	6.0	6.5	4.3	65	50	46	46
Pigmentation—White—Female	4.8	16.2	12.1	15.6	0	0	0	0	62	37	33	32
Pigmentation—Negro—Male	96.4	86.4	94.4	90.0	89.3	81.8	72.2	85.0	28	22	18	20
Pigmentation—Negro—Female	54.8	55.0	61.5	72.7	38.1	40.0	38.5	45.5	42	20	13	11
Meatal Ulcer	5.3	4.0	3.7	3.5	2.3	0.8	0	0	131	125	81	85
Undescended Testes	2.3	0	2.5	0	0	0	0	0	132	124	80	86
Vaginal Discharge	0.7	0	1.7	0	0	0	0	0	141	91	60	58
Hydrocele	6.9	11.3	10.0	8.1	0	0.8	0	0	130	124	80	86
Breast Engorgement	26.9	26.2	26.7	28.7	11.3	11.5	10.5	7.9	186	122	105	101
Skeleton												
Rib Beading—Male	46.3	57.6	54.8	43.0	12.5	14.4	10.7	9.3	136	125	84	86
Rib Beading—Female	39.9	34.3	54.0	52.5	6.8	9.5	9.5	8.5	148	105	63	59
Congenital Dislocation of Hips	0.4	0	0	1.4	0.4	0	0	0	277	228	147	144
Bowed Legs—Male	80.9	71.4	82.1	83.7	33.1	35.7	34.5	31.4	136	126	84	86
Bowed Legs—Female	80.4	68.6	71.9	64.4	23.6	22.9	26.6	16.9	148	105	64	59
Head												
Moulding	3.9	4.0	0.7	5.6	0.4	1.3	0	0	283	227	147	144
Open Sagittal Suture—White	32.5	41.0	37.5	34.0	6.3	13.5	7.7	8.5	191	156	104	106
Open Sagittal Suture—Negro	38.8	41.3	28.2	48.6	20.0	12.7	12.8	18.9	85	63	39	37
Open Posterior Fontanelle—White	30.3	33.1	44.9	32.4	8.1	12.9	20.6	13.9	198	163	107	108
Open Posterior Fontanelle—Negro	43.7	51.5	55.0	63.2	31.0	27.3	37.5	36.8	87	66	40	38
Eyes												
Hyperemia—Lids	5.5	5.5	5.0	5.6	0.7	1.4	1.4	1.4	271	217	141	142
Hyperemia—Sclera	1.5	3.0	0.9	5.6	0	2.3	0	0.9	197	133	109	108
Discharge	4.1	2.8	4.9	7.1	0.4	0	0.7	0.7	271	217	142	141
Hemorrhage—Sclera	0.7	0	2.1	0	0	0	0	0	270	217	143	141
Circumcorneal Injection	6.3	6.0	9.2	5.7	1.1	0.5	0.7	0.7	269	216	142	141

Tongue												
Red or Purple	21.0	22.3	21.7	13.3	—	—	—	—	276	220	143	143
Papillae Hypertrophy	50.7	44.0	45.7	51.4	21.5	14.4	20.7	15.0	274	216	140	140
Papillae Atrophy—White	12.8	14.7	18.0	15.8	3.7	3.8	4.0	2.0	187	156	100	101
Papillae Atrophy—Negro	19.3	19.7	31.6	15.2	3.6	1.6	10.5	6.1	83	61	38	33
Swollen—Male	43.2	38.3	51.9	53.0	15.2	10.8	7.4	15.7	132	120	81	83
Swollen—Female	58.5	58.6	60.7	60.3	12.0	17.2	14.8	15.5	142	99	61	58
Fissures	0.7	1.9	0.7	0	0	0	0	0	268	214	140	136
Gums												
Red or Very Red	4.7	5.0	2.8	4.2	—	—	—	—	274	219	142	142
Hypertrophy	75.3	76.1	84.3	81.5	38.9	39.6	38.0	48.1	198	134	108	108
Pigmentation—White	0.8	0	0	0	0	0	0	0	128	89	77	76
Pigmentation—Negro	46.5	22.7	31.3	33.3	19.7	18.2	3.1	13.3	71	44	32	30
Swollen	7.4	7.8	2.1	2.8	0	0.9	0.7	0	271	219	140	141
Teeth	0	0	3.0	0	0	0	0	0	137	123	66	73
Lips												
Fissures	13.2	19.7	15.5	15.5	2.2	3.7	4.2	5.6	273	218	142	142
Blisters	61.6	65.7	61.3	58.2	35.9	35.1	37.8	34.5	198	134	111	110
Swollen	2.2	5.5	0.7	0.7	0.4	0.9	0	0	271	218	140	141
Central Nervous System												
Moro Reflex	35.8	32.4	39.7	39.2	3.6	2.3	4.3	4.2	274	222	141	143
Hyperactivity	0.4	0	1.4	0.7	0	0	0.7	0	270	215	142	143
Skin												
Abnormal Hair Distribution—White	67.0	68.3	75.0	74.5	1.5	1.9	1.0	2.8	194	161	104	106
Abnormal Hair Distribution—Negro	59.5	52.5	60.0	48.6	0	3.3	0	0	84	61	40	37
Scaling	12.3	13.2	16.4	12.1	0.7	1.8	1.4	0	277	219	146	141
Eruptions—White	52.3	52.1	50.5	49.5	6.1	8.6	3.7	6.5	197	163	107	107
Eruptions—Negro	37.9	42.4	40.0	42.1	5.7	6.1	7.5	7.9	87	66	40	38
Cradle Cap	9.2	12.9	11.8	7.3	3.6	7.6	2.7	0.9	195	132	110	110
Hemangioma—Lids—White	38.1	25.6	24.1	26.9	8.7	8.9	5.1	6.4	126	90	79	78
Hemangioma—Lids—Negro	14.3	9.1	21.9	29.0	1.4	2.3	0	3.2	70	44	32	31
Hemangioma—Forehead	13.8	14.9	12.6	16.8	2.0	2.2	4.5	1.9	196	134	111	107
Diaper Rash—White	17.2	25.6	20.8	16.9	4.7	6.7	6.5	3.9	128	90	77	77
Diaper Rash—Negro	2.9	4.5	9.4	3.2	0	0	6.3	0	70	44	32	31

THE INFLUENCE OF WAR AND POST-WAR CONDITIONS ON THE TEETH OF NORWEGIAN SCHOOL CHILDREN[1]

I. ERUPTION OF PERMANENT TEETH AND STATUS OF DECIDUOUS DENTITION

GUTTORM TOVERUD[2]

INTRODUCTION

AFTER World War I a marked reduction in dental caries in children was reported from several countries in Europe: from Norway, by Ramm (1919); from Sweden, by Bensow (1919); from England, by Wheatley (1920); and from Germany, by Wimmenauer (1929). Later, during the Spanish Civil War (1936–1939), a similar condition was found by Adler (1941) in Spanish children.

When World War II broke out, in September, 1939, the Pedodontic Department of the Norwegian State Dental School began to plan a comprehensive dental study of Norwegian school

[1] From the Norwegian State Dental School, Pedodontic Department, Oslo, and the Milbank Memorial Fund.

[2] Dr. Philos., Oslo; F.D.S.R.C.S., England and Edinburgh; Professor of Pedodontia.

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I want to express my sincere thanks to Miss Dorothy G. Wiehl, who has been responsible for the statistical treatment, for her interest and constant help. I am also indebted to her for reading the manuscript. I am very grateful to Mr. Louis Rubal for his painstaking work and many interesting and valuable suggestions. Thanks are also due to the other members of the staff for help in various ways.

children to see whether a similar reduction in dental caries would occur again under wartime conditions, and if so, to study the causes.

The proposed study was to be carried out in cities, villages, and rural districts in various parts of Norway. Children were to be examined in all the seven grades into which the Norwegian grammar school is usually divided. Initial plans were for a five-year study, a three-year war period (the estimated length of the war then beginning), and a two-year postwar period as a sort of control. The war, however, lasted five years, and the study had to be extended to cover a postwar period of observation. The main period of the study thus lasted from 1940–1941 through 1948–1949. After a two-year lapse, caused by lack of funds, a reduced number of children was examined in 1951–1952 and 1952–1953.

For such an extended nationwide study, it was essential to obtain the voluntary cooperation of the dentists in the school dental clinics scattered over Norway. Such cooperation was elicited and brought forth a very gratifying response, twenty-two school dental clinics in widely separated sections of Norway promising to carry out the necessary examinations for the duration of the study. We are fortunate that most of the dentists were able to carry on the necessary examinations in most of the original schools for the whole period of study.

After Norway was invaded by the Germans, in April, 1940, many special difficulties arose—school premises with dental clinics were occupied by the enemy, school dentists moved away, and so on. The difficulties worsened as the occupation continued, so that the original overall estimate of children to be examined annually—around 10,000—could not be maintained in practice.

The Population Examined

It was originally planned, as noted, to study children from schools in cities, villages, and rural districts[3] in different parts

[3] I am indebted to the actuary, Mr. F. Alexander, for his help in the grouping, as well as in other aspects in the planning of the study.

Table 1a. Number of children, boys and girls combined, examined in each school year in different cities, by age groups 7–8, 9–11, and 12–13 years.

City	Age (Years)	Year of Examination										
		1940–41	1941–42	1942–43	1943–44	1944–45	1945–46	1946–47	1947–48	1948–49	1951–52	1952–53
		Number of children										
Fredriksted	7– 8	100	211	208	200	197	190	261	271	249	215	244
	9–11[a]	2	17	41	54	38	34	58	48	45	45	30
	12–13	133	215	211	223	221	153	208	217	236	136	167
Tönsberg	7– 8	228	187	194	182	188	197	182	216	205	265	277
	9	7	10	1	6	5	—	8	7	9	1	3
	12–13[b]	59	—	70	69	61	82	55	66	69	122	72
Larvik[1]	11	2	16	—	—	3	—	2	—	—	17	12
	12–13	158	89	—	105	153	127	103	125	40[c]	193	185
Egersund	7– 8	73	83	82	73	70	76	66	79	85	129	126
	9–11	68	99	100	103	106	102	100	106	98	119	124
	12–13	2	14	43	74	66	75	80	61	73	94	106
Skudenesshavn	7– 8	40	44	41	37	38	51	57	52	45	65	66
	9–11	48	49	50	51	55	56	53	65	72	74	73
	12–13	34	26	26	35	32	34	33	26	31	36	39
Tromsö	7– 8	54[d]	133	127	154	86	123	175	196	163	—	—
	9–11	—	1	50	109	138	172	21	13	13	—	—
	12–13	—	—	75[e]	128	119	91	63	92	113	—	—
Trondheim[2]	7– 8	424	577	527	310	266	314	438	82	—	90	85
	12–13	610	581	490	313	329	446	382	198	—	122	219
Porsgrunn[2]	7	72	55	64	69	67	69	—	—	—	—	—
	13	108	60	74	89	56	69	—	—	—	—	—

[1] At ages 7 and 8, information recorded only for selected teeth, data not used.
[2] Not included in combined cities.
[a] Ages 9 or 11 except for 1 or 2 per year aged 10 years.
[b] Age 13 only except for 1 to 5 children per year from 1942–43 to 1948–49 and 25 age 12 in 1951–52.
[c] Age 13 except 1 child aged 12.
[d] Age 7 only.
[e] Age 12 only except for 7 children.

Table 1b. Number of children, boys and girls combined, examined in each school year in different village communities, by age groups 7–8, 9–11, and 12–13 years.

Village Community	Age (Years)	1940–41	1941–42	1942–43	1943–44	1944–45	1945–46	1946–47	1947–48	1948–49	1951–52	1952–53
		Number of children										
Tune	7– 8	38	40	32	31	29	33	38	30	41	—	—
	9–11	23	7	1	3	6	1	4	7	5	—	—
	12–13	35	44	39	33	32	26	42	41	30	—	—
Ski	7– 8	85	63	64	59	62	73	—	79	79	—	—
	9–11	134	132	119	110	74	73	—	67	92	—	—
	12–13	79	86	80	68	74	68	—	39	46	—	—
Oppegård	7– 8	70	89	76	82	89	97	95	113	102	137	207
	9–11	13	67	3	93	127	116	156	137	134	164	172
	12–13	76	94	89	103	106	92	72	97	103	107	97
Aker	7	52	48	25	21	31	21	—	—	—	—	—
	8	14	4	2	2	—	1	—	—	—	—	—
	12	2	7	3	9	15[a]	7	—	—	—	—	—
	13	42	37	28	15	17[a]	11	—	—	—	—	—
Bærum	7– 8	208	214	217	186	149	154	193	203	172	104	147
	9	1	5	59	7	2	8	46	5	5	—	2
	10–11	10	12	12	10	13	8	16	11	7	32	—
	12–13	96	78	81	153	154	197	196	164	165	68	125
Eidsvoll	7– 8	18	11	13	15	13	19	14	11	12	—	—
	9–11	11	14	2	2	6	—	5	2	2	—	—
	12–13	11	7[b]	15	18	15	18	19	14	13	—	—
Hedrum	7– 8	61	37	59	54	57	76	—	27[c]	43	—	—
	9–11	6	7	3	10	2	8	—	5	9	—	—
	12–13	6	25	42	45	53	48	—	43	46	—	—
Stord	7– 8	59[d]	128	132	117	—	141	131	149	157	166	193
	9–11[e]	—	5	59	113	—	193	182	208	187	222	232
	12–13	—	—	—	—	—	105	65[f]	120	111	132	150
Odda	7– 8[g]	93	83	135	96	53	59	27	37	28	—	—
	9–11[h]	122	111	129	8	31	30	17	10	10	—	—
	12–13	141	82	130	120	137	148	76	58	49	—	—
Strinda	7– 8	36	45	82	77	71	96	15[i]	—	—	—	—
	9–11	56	33	117	151	90	100	—	—	—	—	—
	12–13	70	46	35	69	55	59	—	—	—	—	—
Gjerpen[1]	7– 8	199	201	207	186	204	244	281	254	241	338	408
	9–11	384	368	364	342	349	328	333	374	411	381	433
	12–13	303	289	283	267	266	242	242	226	204	329	311

[1] Not included in combined villages.
[a] Boys only.
[b] Age 13 only.
[c] Age 7 except 1 child.
[d] Age 7 except 6 children.
[e] Ages 9 and 10 only in 1941–42, 1942–43, and 1943–44, except 3 age 11 in 1943–44.
[f] Age 12 except for 8 children.
[g] Age 8 beginning in 1943–44.
[h] Age 9 only beginning in 1943–44.
[i] Age 7 only except 1 child.

Table 1c. Number of children, boys and girls combined, examined in each school year in different rural districts, by age groups 7–8, 9–11, and 12–13 years.

Rural District	Age (Years)	Year of Examination										
		1940–41	1941–42	1942–43	1943–44	1944–45	1945–46	1946–47	1947–48	1948–49	1951–52	1952–53
		Number of children										
Blaker	7– 8	19	23	21	17	15	19	—	—	—	—	—
	9–11	26	22	26	30	31	27	—	—	—	—	—
	12–13	20	18	15	12	15	13	—	—	—	—	—
Fet	7– 8	63	55	69	90	88	115	91	81	86	94	110
	9–11[a]	22	105	31	9	11	15	16	11	16	18	8
	12–13	56[b]	76	86	75	81	98	69	68	87	84	81
V. Gaudal	7– 8	48	—	—	58	80	77	75	62	69	—	—
	9–11	2	—	—	103	90	88	96	113	109	—	—
	12–13	29[c]	—	—	61	57	59	59	48	49	—	—
Meldal	7– 8	19	15	19	13	17	14	18	15	21	—	—
	9–11	37	49	41	39	34	30	22	24	19	—	—
	12–13	23	20	22	30	31	21	25	18	15	—	—
Brunlanes	7– 8	80	70	82	68	68	61	64	54	66	—	—
	9–11[d]	5	9	8	9	5	11	15	13	8	—	—
	12–13	50	45	57	64	68	55	52	62	63	—	—
Hedrum	7– 8	102	76	82	76	81	66	—	68	79	—	—
	9–11[d]	12	11	9	15	4	11	—	11	9	—	—
	12–13	29	45	72	58	84	79	—	26	91	—	—
Grue[1]												
	7– 8	—	—	—	141	131	132	156	119	87	180	201
	9–11	—	—	—	269	282	267	246	238	164	282	296
	12–13	—	—	—	184	168	183	182	165	104	196	182

[1] Not included in combined rural groups.
[a] Age 9 or 11 beginning in 1943–44 except 4 children age 10.
[b] Age 13 except 7 children.
[c] Age 13 only.
[d] None at age 10.

of Norway in order to see if changes in dental conditions, if any, would be uniform and possibly to obtain an average or overall picture for the Norwegian school population. However, the necessity of obtaining the voluntary cooperation of dentists before the study began resulted in the inclusion of communities on a basis that could not provide a representative sample of the whole school-age population of Norway. This does not, however, invalidate the data for the population actually selected. In light of later developments, especially the effects of the German Occupation, annual examinations of a school population from communities selected by random sampling procedures would not have proved possible throughout this period. Furthermore, a rigorously selected representative sample of Norwegian school children was not essential to the principal objective of the study which was to investigate any changes in dental caries that might occur during the war years and to relate these changes to war conditions, such as food shortages and rationing.

Variation from year to year in the composition of the population examined has been a troublesome problem in the analysis of these data on dental conditions. Examinations were not done in every community in every year; the same school grades were not included in every community; and, in some communities, the grades examined or numbers of children examined, varied from year to year. (*See* Tables 1a, 1b, and 1c.) As a result, the numbers of children examined at different ages varied and, for any specific sex-age group, the numbers varied from year to year. Furthermore, of the total examinations for different sex-age groups, the proportions from the various communities differed from group to group, and for any specific sex-age group, the proportions from the various communities differed from year to year.

The influence of year-to-year variation in community composition of the examined population has been controlled or minimized chiefly by grouping those communities which seemed to be comparable with respect to dental conditions and by tab-

ulating data from some districts separately. Examinations from several communities which were represented in only a few years were discarded completely. Three basic groups of communities, namely cities, villages, and rural districts, have been maintained throughout the analysis. Included in each group are the communities which showed no consistent differences with respect to eruption of permanent teeth or caries rates by sex and age and also did not differ markedly in the trends of these variables within the period of study. Some small districts, which did not provide sufficient numbers of children for tests of homogeneity, were assigned to or pooled with the appropriate general community group. One city, Trondheim, and one village, Gjerpen, with relatively large populations examined throughout the study, have been analyzed separately. The rural community, Grue, is tabulated separately because the examinations were not started until 1943–1944, too late to establish levels for dental status at the beginning of the war period. Some data will be presented for several other communities for which examinations are available for only a part of the study period. There was considerable reduction in the population examined from rural districts and the rural group used for analysis may not be broadly representative of the rural school children.

Method of Examination and Data Recorded

The basic data of the study consists of recorded, annual dental examinations of grammar school children ranging in age from 7 to 13 years (a few children aged 6.5 and 14 years were examined). A child cannot enter the public school in Norway unless it passes its seventh birthday sometime during the first calendar year of the school-year period.

Wherever feasible the children were examined in all the seven grades into which the Norwegian grammar school is usually divided. When it was found that a dentist would not be able to examine all seven grades he was asked to concentrate on grades 1, 2, 6, and 7. This led to a better representation at ages 7, 8, 12, and 13 than at ages 9, 10, and 11 years. Certain disadvan-

tages for the analysis resulted from this poorer representation at ages 9, 10, and 11 years, and these may be briefly mentioned here.

The study had at first been planned to serve a longitudinal analysis, rather than a cross-sectional one; that is, the same children would be examined from year to year. The successive matched cohorts could then be compared. When grades 3, 4, and 5 began to be omitted in so many of the districts, later examination of the same children could not always be maintained, even though the recording charts were in fact worked out so that comparisons for individuals at successive examinations could be made if necessary. In districts where the longitudinal approach could be utilized, however, the results proved confirmatory of the more general cross-sectional one.

The examinations of the children were planned to take place at twelve-month intervals with no interval to differ by more than three months either way. Occasionally, these intervals were outside the limits planned and in a few instances contribute to irregularities in trends in annual rates.

Another disadvantage resulting from the poorer representation at ages 9, 10, and 11 years is akin to that for the longitudinal evaluations. These are the ages at which the permanent cuspids and bicuspids are erupting and change in eruption time could not always be evaluated without better representation at ages 9, 10, and 11 years. In the case of the caries process, the caries picture at ages 7 and 8 is largely limited to the permanent first molars, even for groups of children in high-caries districts. The lack of data between ages 8 and 12 years limits the information on certain characteristics of the caries process, particularly if caries activity in specific teeth and specific surfaces is studied.

The dental examinations included the following items:

1. Presence of deciduous teeth; untreated carious and filled deciduous teeth, with surface location. Deciduous incisors were not considered in view of the ages of the children studied.

2. Eruption and presence of permanent teeth; untreated carious and filled permanent teeth, with surface location.

All extracted permanent teeth have been counted as erupted. Premolars extracted for orthodontic reasons have been marked, and such teeth were not counted as carious unless this was so stated. Permanent first and second molars extracted were counted as having been carious.

Diagnosis of Caries. The examination was made with the aid of a dental mirror and explorer, and x-rays were used only when the dentist was uncertain whether a tooth was impacted or congenitally absent. The omission of x-rays in the examination for dental caries usually leads to an underestimate of the number of decayed teeth (Chilton and Greenwald, 1947). Proximal caries particularly may go undetected in a fairly large percentage of cases (Sognnaes, 1940). There is, however, considerable consistency in this underestimation, and this factor should have little or no effect on the trend of caries frequency over a period of years when the same method of examination is used throughout the study.

As is well known by dentists, the clinical diagnosis of caries sometimes proves difficult, and different dentists may diagnose a real caries-lesion or a pre-caries lesion differently. In this study post-eruptive defects of the crown were taken as caries-lesions when the explorer caught or stuck. But the diagnosis of caries in the fissure areas of the permanent molars may be very difficult since the explorer may stick in a narrow fissure even if the caries process has not started.

It should be pointed out, however, that all the dentists taking part in the present study were trained in the same dental school and in the same system of examination and diagnosis. This, of course, does not necessarily ensure the maintenance of the same diagnostic criteria in practice, and to some extent, the evaluation of the findings must take this into account. However, most of the dentists had had long experience in the diagnosis of caries in connection with caries therapy in children in their school clinics. Nevertheless, one has to consider the pos-

sibility of a rather wide difference in the numbers of decayed teeth, as well as of surfaces diagnosed as carious, when different dentists examine the same group of children (Gythfeldt, 1938).

Where the same dentist made all the examinations throughout the period of the study in a district for which the findings have been kept separate, the problem of variability of criteria among dentists does not arise. Even here the more insidious one of possible change with time might be present.

In regard to determining the *extent* of the carious lesion in the specific tooth, no attempt was made to grade the lesion except to indicate the specific surfaces affected. Different methods of grading the extent of caries, both as regards surface extension and penetration in depth, have been described. Among these the Swedish Moulage System (Westin, 1943) seems to offer great possibilities. However, since the present study was planned and begun before the details of that system were published, it could not be applied from the beginning, and it was not considered advisable to introduce it later.

Diagnosis of Eruption of the Permanent Teeth. When to count a permanent tooth as erupted has not been standardized. Looking through the literature, Hurme (1949) found various criteria; they ranged from counting a tooth as erupted at its first appearance through the gum (Degerbøl, 1929–1932), up to the stage at which one-third of the crown of an anterior tooth, or the whole occlusal surface of a molar or premolar is visible (Parfitt, 1954). Most authors, however, recognize a tooth as erupted when about 1 mm. of the crown is free from the gingiva (Klein and Palmer, 1938). This is the standard adopted in this study, and it is believed that it was fairly well maintained by all the dentists.

Recording of the Examination. The examinations were recorded on a specially designed chart or sheet, a modification of the geometrical chart of Bodecker (1939). Each chart was intended to include the examinations in one class or grade in the specified district in one school year, but more sheets were used

if necessary. At the top of each sheet, space was provided for the name of the community or district, name of the dentist, school and grade, and date of examination; and immediately below this was a complete detailed set of instructions to which the recording secretary could easily refer while the dentist dictated his findings.

The body of the chart consisted of a series of double rows of horizontal squares. Squares in each double row represented specific teeth of the individual child, and were numbered from 1 (the central incisor) to 7 (the permanent second molar), the maxillary teeth in the upper horizontal row and the mandibular teeth in the lower row. At the extreme left of the sheet, space was provided for an identifying number assigned to the child for the duration of the study. Columns at the left also provided space to enter the child's sex and age, and to record a summary count of the numbers of deciduous and permanent teeth present or erupted, the numbers affected with caries, and the number of permanent teeth extracted.

Within each square, representing a specific tooth, standardized marks described the condition of the tooth. A deciduous tooth present was identified by a zero (0) to the left of the number (Haderup 1894). A permanent tooth not erupted was indicated by a single diagonal stroke through the number; and if the permanent tooth had been extracted, by a large X. Carious spots and fillings in specific surfaces were recorded in the appropriate locations in accordance with the schema devised and clearly printed on each sheet. Certain special notations, *e.g.*, those concerning complete absence of observed caries, presence of rickets, marked anomalies of growth, congenital absence of teeth, etc., could be written in, when necessary, in abbreviated form.

While space was provided for the examination in both right and left sides of the mouth, such complete examinations were made only during the first two years of the study, in 1940–1941 and 1941–1942. Earlier studies of bilateral symmetry in caries —among others, by Brekhus (1931)—had indicated that in

large-scale studies it is unnecessary to examine the dentition in both sides of the mouth in order to get a true picture of the dental status of the groups involved. In this study, too, preliminary calculations, in terms of per cent of teeth affected by caries in the right and in the left side of the mouth, in children examined in the first two years, confirmed the earlier reported findings of close bilateralism. As a result, after 1941–1942 only the teeth in the right side of the mouth were examined. However, if the dentition on the right side was completely free of caries, the left side was examined in order to be sure that the child was really caries-free clinically.

When examinations in a district for a school year were finished, the sheets were sent to the Pedodontic Department at Oslo for scrutiny and editing. Since each child was to retain his assigned number for the duration of the study, an attempt always was made to compare the dental status at each examination with the status in the preceding one. Whenever obvious discrepancies were noted, the original sheet was returned to the dentist and the child, if possible, re-examined. For various reasons this method of control could not always be performed.

Tabulation and Analysis of Data

This report is concerned chiefly with trends in rates for dental caries and in eruption of permanent teeth among Norwegian school children during a period from 1940–1941 to 1948–1949, inclusive, and in 1951–1952 and 1952–1953. As discussed above, there was considerable variation from year to year in the community composition of the examined population. Effects of war conditions are not necessarily alike in all communities, nor do school children in different communities have comparable dental experience in normal times. Consequently, differences among communities as to dental status at the beginning of the war and as to trends within the study period were examined carefully. Some differences were found, especially in levels of the initial rates, and also, in a few districts, in the magnitude of the change that occurred. Three basic community groups were

formed, namely, cities, villages, and rural districts, from communities with comparable findings and with examinations available in most of the study years. Several communities with fairly large numbers of children examined have been tabulated separately either because of some difference in findings or because the community was in the study for a limited period. This method of presenting the data has resulted in the analysis of findings for a number of relatively small groups and, therefore, in rates subject to fairly large variations due to small numbers as well as other sources of error discussed above. However, it has the advantage of giving a more detailed and complete picture of changes than could be obtained from statistically adjusted average rates for larger groups. Furthermore, the general consistency of trends for the various communities gives greater validity to the findings.

Rates usually are shown for each sex and single years of age. For some purposes, ages 7 and 8 or 12 and 13 years have been combined; at these ages, the maximum numbers of children were examined and in most school years the numbers at adjacent ages differed little.[4] At ages 9, 10, and 11 years, representation from communities included in the basic groups differed from that at other ages; some communities are not represented or very few children were examined. Consequently, comparisons from age to age are not necessarily reliable.[5] Changes from year to year for a specific sex-age group may be affected by the population sample examined but, in general, trends over the study period are representative and valid. A smoothing of trends, especially in regard to eruption status, has been found

[4] Rates for the combined ages 7 and 8 or 12 and 13 years are based on total numbers examined. Rates for permanent tooth eruption adjusted for four six-month age periods differed so slightly from unadjusted rates over a series of school years that age adjustment was discontinued. Similarly, for the basic community groups, annual dental caries rates were adjusted to a constant proportion from each community; the effect was so small that the unadjusted rates have been used.

[5] If the same cohorts of children were examined in each community in successive years, numbers of erupted teeth and rates for caries in the permanent dentition could not decrease with advancing age. Similarly, cross-sectional samples at successive ages in a given school year would not be expected to show decreases with advancing age if the samples are large and representative. Rates for the small population groups analyzed in the following sections do show wide fluctuations and sometimes decrease with age.

useful, and has been accomplished by using simple moving three-year averages of the observed annual rates.

For some purposes, city and village groups have been combined, and Gjerpen also may be added. It was found that the pattern of change over the study period was very similar for these population groups, although the levels might differ to some extent. When combined, group rates were averaged so that each group has equal weight in the combined rate and equal weight in each year.[6]

Statistical tests of significance are used sparingly in the following analyses of changes. Sources of variation and error in the data are not limited to those associated with random sampling, and other problems inherent in these data make conventional tests of limited value. Internal consistency of results of examinations by many different dentists in different communities affords the best evidence of the validity of the findings.

Changes in the Rate of Eruption of Permanent Teeth during the Years 1940–1941 to 1948–1949

Early during the present study it became evident that the average number of permanent teeth per child in the respective chronological age groups changed from year to year. A special study, therefore, has been undertaken to investigate these changes. The three community groups: cities, villages, and Gjerpen[7] only will be dealt with as far as the total period is concerned. The material from the combined rural districts, however, was too heterogeneous to be used in this particular study. One rural community, Grue, with a fairly large group examined, also illustrates this change in eruption of permanent teeth from 1943–1944, the first year this community was included in the study.

The range for the normal eruption of the twenty-eight perma-

[6] Exceptions to this method of combining groups were made and will be noted in the proper sections.

[7] Gjerpen showed a different caries picture from the other villages in the combined village group and had to be studied separately in analyzing trends in caries rates. For this reason, Gjerpen is not included in the village group.

Table 2a. Number examined in each school year in the cities, and villages, and in Gjerpen, 1941–1949, and in Gjerpen 1951–1952, and 1952–1953.

School Year	Boys							Girls						
	Number Examined at Specified Age							Number Examined at Specified Age						
	7	8	9	10	11	12	13	7	8	9	10	11	12	13
	CITIES													
1940–41	163	92	22	26	18	103	103	143	92	31	21	9	90	90
1941–42	149	157	33	21	36	103	65	209	137	36	32	34	85	91
1942–43	161	154	64	27	32	112	118	153	183	54	22	43	104	91
1943–44	171	156	87	47	33	130	174	181	134	79	45	33	159	171
1944–45	149	141	64	46	63	156	164	160	126	65	50	58	141	191
1945–46	212	143	76	53	53	85	185	126	148	67	51	64	101	191
1946–47	204	200	55	36	36	122	149	181	143	54	20	41	132	139
1947–48	224	187	70	23	48	100	176	234	163	44	27	30	132	179
1948–49	208	169	46	34	40	114	171	189	177	55	28	34	126	151
	VILLAGES													
1940–41	220	151	64	59	77	131	165	215	143	65	43	69	117	145
1941–42	184	180	89	56	67	121	145	204	188	91	40	50	103	137
1942–43	236	192	122	74	58	110	165	220	184	125	74	51	112	155
1943–44	182	212	109	67	69	140	193	151	188	102	98	62	122	178
1944–45	125	138	82	50	51	170	190	153	131	65	50	53	131	167
1945–46	187	201	108	81	88	172	228	167	209	100	80	81	191	188
1946–47	135	121	96	68	52	120	129	124	128	99	52	59	118	103
1947–48	162	158	78	72	71	146	149	177	142	75	84	72	137	142
1948–49	156	155	104	62	72	144	155	137	177	68	55	90	124	140
	GJERPEN													
1940–41	38	65	68	58	66	64	82	44	51	62	60	70	74	83
1941–42	55	59	69	63	59	75	63	43	44	54	61	62	73	78
1942–43	51	66	54	61	80	59	76	34	55	49	58	62	66	82
1943–44	43	57	65	60	60	66	69	41	44	53	51	53	71	61
1944–45	53	51	55	72	69	59	72	55	45	45	54	54	63	72
1945–46	60	60	54	60	66	71	59	64	57	48	47	53	52	60
1946–47	72	69	64	54	60	61	72	64	73	67	41	47	57	52
1947–48	59	72	78	64	55	65	67	55	67	71	59	47	50	44
1948–49	55	66	78	73	62	60	49	56	64	60	77	61	48	47
1951–52	92	75	71	65	57	100	80	99	70	63	62	63	83	66
1952–53	112	98	84	74	58	84	89	89	107	78	73	66	68	70

Table 2b. Average number of permanent teeth per child by sex and chronological age in each school year for children in cities, in villages, and in Gjerpen, 1941–1949, and in Gjerpen 1951–1952 and 1952–1953.

School Year	Boys							Girls						
	Average Number at Specified Age							Average Number at Specified Age						
	7	8	9	10	11	12	13	7	8	9	10	11	12	13
	CITIES													
1940–41	8.3	11.4	12.6	16.0	21.3	25.6	26.8	9.8	12.6	15.2	18.7	23.6	26.5	27.1
1941–42	8.8	11.4	15.0	15.4	21.4	24.9	27.0	9.7	12.4	14.9	18.7	23.6	26.2	27.3
1942–43	8.5	11.2	14.3	18.5	18.9	23.9	26.3	9.5	12.3	15.1	19.3	23.8	25.8	27.1
1943–44	8.6	11.4	12.6	16.9	20.7	23.9	26.5	9.4	12.1	14.0	17.9	23.0	25.8	27.0
1944–45	8.4	11.6	13.2	16.0	20.6	23.8	26.0	9.2	11.4	14.6	18.2	21.9	25.2	26.8
1945–46	8.0	10.8	12.6	16.0	19.8	23.7	26.0	9.0	11.9	14.2	17.9	21.8	25.4	26.9
1946–47	7.9	10.4	12.6	15.3	20.3	23.4	25.7	9.1	11.5	13.4	16.0	23.2	25.0	27.0
1947–48	8.2	10.4	12.3	15.2	19.5	24.2	26.0	9.2	11.9	14.4	16.9	20.5	25.3	27.0
1948–49	8.2	10.8	13.0	15.4	20.0	23.4	26.5	9.7	11.6	13.6	16.9	21.0	25.2	26.8
	VILLAGES													
1940–41	8.6	11.2	13.4	17.2	20.8	25.1	26.5	9.6	12.1	15.1	18.9	22.8	25.7	27.0
1941–42	8.6	11.4	13.5	16.6	21.0	25.1	26.6	9.5	12.0	14.8	19.4	22.6	25.6	27.0
1942–43	8.6	11.3	13.4	15.8	21.5	24.7	26.5	9.5	12.4	15.1	18.6	23.1	26.0	26.9
1943–44	8.0	11.0	13.0	16.7	20.2	24.0	25.9	8.8	11.7	15.1	18.7	22.2	25.2	27.3
1944–45	8.0	10.6	12.1	15.7	21.7	24.0	26.2	8.7	11.4	13.3	18.4	22.2	24.8	27.0
1945–46	8.0	10.7	13.0	15.2	19.9	23.8	26.1	8.6	11.7	13.7	17.7	22.1	25.5	26.7
1946–47	8.2	10.6	12.9	15.1	20.1	23.8	25.9	8.9	11.3	14.1	18.0	21.7	25.4	26.7
1947–48	7.8	10.8	12.7	15.1	19.4	23.1	26.4	8.7	11.5	13.1	17.4	21.1	25.2	26.9
1948–49	8.0	10.7	12.5	14.7	19.9	22.8	25.6	9.5	11.5	14.1	16.3	21.9	24.5	26.5
	GJERPEN													
1940–41	8.2	10.8	13.9	16.6	22.2	24.6	26.4	9.2	12.4	15.9	19.5	22.5	25.5	26.9
1941–42	8.6	11.7	13.8	17.3	20.3	25.0	26.8	9.3	12.5	15.8	19.8	23.5	25.3	27.3
1942–43	8.3	10.9	13.8	17.0	21.2	23.8	26.3	8.3	12.3	15.4	19.3	23.5	26.3	26.6
1943–44	8.7	11.2	13.2	16.5	20.3	24.2	25.9	9.6	11.0	15.4	20.2	23.1	26.3	27.2
1944–45	8.0	11.4	13.3	16.4	20.9	23.3	26.5	8.8	12.4	13.6	18.4	22.8	25.4	27.2
1945–46	8.6	10.3	13.3	15.7	19.8	23.9	24.8	9.3	11.7	14.8	17.4	22.3	25.2	27.0
1946–47	8.1	10.5	12.3	16.4	19.8	22.9	26.2	9.0	11.8	13.7	19.1	20.0	25.9	26.5
1947–48	8.2	10.7	12.5	14.5	20.4	24.5	25.6	9.5	11.9	14.0	17.0	22.3	23.8	26.6
1948–49	8.4	11.0	12.3	15.4	17.8	23.6	25.7	8.7	12.4	14.2	17.9	21.1	24.3	26.3
1951–52	8.1	10.6	12.9	15.8	18.8	23.4	25.9	9.3	12.0	14.6	18.3	21.8	25.4	27.1
1952–53	8.0	11.4	12.8	16.4	19.6	22.6	26.2	9.2	12.1	14.2	18.6	22.0	24.7	26.8

School Year	Boys			Girls		
	Average Number of Teeth			Average Number of Teeth		
	7.0–7.4[1]	7.0–7.9	8.0–8.9	7.0–7.4[1]	7.0–7.9	8.0–8.9
1940–41	7.4	8.5	11.3	9.0	9.7	12.3
1941–42	8.1	8.7	11.4	8.7	9.6	12.2
1942–43	7.5	8.5	11.3	8.4	9.5	12.3
1943–44	7.5	8.3	11.1	7.9	9.1	11.8
1944–45	7.1	8.2	11.1	8.1	9.0	11.4
1945–46	7.0	8.0	10.7	7.8	8.8	11.8
1946–47	6.5	8.0	10.5	8.2	9.0	11.4
1947–48	7.2	8.0	10.6	8.1	9.0	11.7
1948–49	7.2	8.1	10.8	8.8	9.6	11.6
	Number of Children					
1940–41	190	383	243	203	358	235
1941–42	158	333	337	212	413	325
1942–43	165	397	346	173	373	367
1943–44	168	353	368	161	332	322
1944–45	131	274	279	164	313	257
1945–46	210	399	344	137	293	357
1946–47	160	339	321	150	305	271
1947–48	185	386	345	201	411	305
1948–49	190	364	324	165	326	354

[1] Included in age group 7.0–7.9 years.

Table 3. Average number of erupted permanent teeth per child for 7 and 8 year old boys and girls in cities and villages, 1941–1949.

nent teeth during childhood is between 6 and 14 years. The present material covers the upper limit but not the lower one, since children in Norway enter grammar school around the seventh year.

The changes in time of eruption have been studied both as to the average number of erupted permanent teeth per child and as to the percentages of children with specific teeth erupted at each chronological age.

Average Number of Erupted Permanent Teeth Per Child at Different Ages.[8] Each of the three community groups, cities, villages, and Gjerpen, shows practically the same picture of

[8] All averages for number of teeth erupted shown in the tables are for the whole mouth, and are twice the averages obtained from examinations of only one side of the mouth.

School Year	Boys of Specified Age					Girls of Specified Age				
	9	10	11	12	13	9	10	11	12	13
	AVERAGE NUMBER OF ERUPTED PERMANENT TEETH									
1940–41	13.5	16.7	21.4	25.2	26.5	15.4	19.2	22.7	25.9	27.0
1941–42	13.9	16.7	20.8	25.0	26.7	15.1	19.4	23.2	25.7	27.1
1942–43	13.7	16.7	20.9	24.2	26.4	15.2	19.0	23.4	26.0	26.9
1943–44	12.9	16.7	20.3	24.0	26.1	14.8	18.9	22.7	25.7	27.1
1944–45	12.8	16.1	21.0	23.8	26.2	13.9	18.4	22.3	25.1	27.0
1945–46	12.9	15.6	19.9	23.8	25.9	14.1	17.6	22.1	25.4	26.8
1946–47	12.6	15.6	20.0	23.5	25.9	13.8	18.0	21.6	25.3	26.8
1947–48	12.5	14.9	19.8	23.8	26.1	13.7	17.2	21.4	25.0	26.9
1948–49	12.5	15.1	19.1	23.2	26.0	14.0	17.2	21.5	24.8	26.6
	NUMBER OF CHILDREN									
1940–41	154	143	161	298	350	158	124	148	281	318
1941–42	191	140	162	299	273	181	133	146	261	306
1942–43	240	162	170	281	359	228	154	156	282	328
1943–44	261	174	162	336	436	234	194	148	352	410
1944–45	201	168	183	385	426	175	154	165	335	430
1945–46	238	194	207	328	472	215	178	198	344	439
1946–47	215	158	148	303	350	220	113	147	307	294
1947–48	226	159	174	311	392	190	170	149	318	365
1948–49	228	169	174	318	375	183	160	185	298	338

Table 4. Average number of erupted permanent teeth per child at ages 9 to 13 years for boys and girls in cities, villages and Gjerpen, 1941–1949.

tooth eruption both at the start and at the end of the period for all the age groups 7–13 years. (*See* Tables 2a and 2b.) Some minor differences were found but there is a similar downward trend over the period in the average number of permanent teeth for each sex-age group in the different communities. At ages 7 and 8 years, the annual averages for children in Gjerpen are so variable that the trend is not clear; these data have been kept separate, and data for cities and villages have been combined. At ages 9 to 13 years, the three community groups have been combined. The average number of erupted permanent teeth for the combined population at each sex and age is shown in Tables 3 and 4, and illustrated in Figure 1.

In all of the age groups, girls have a greater number of erupted permanent teeth than boys. This is in accordance with

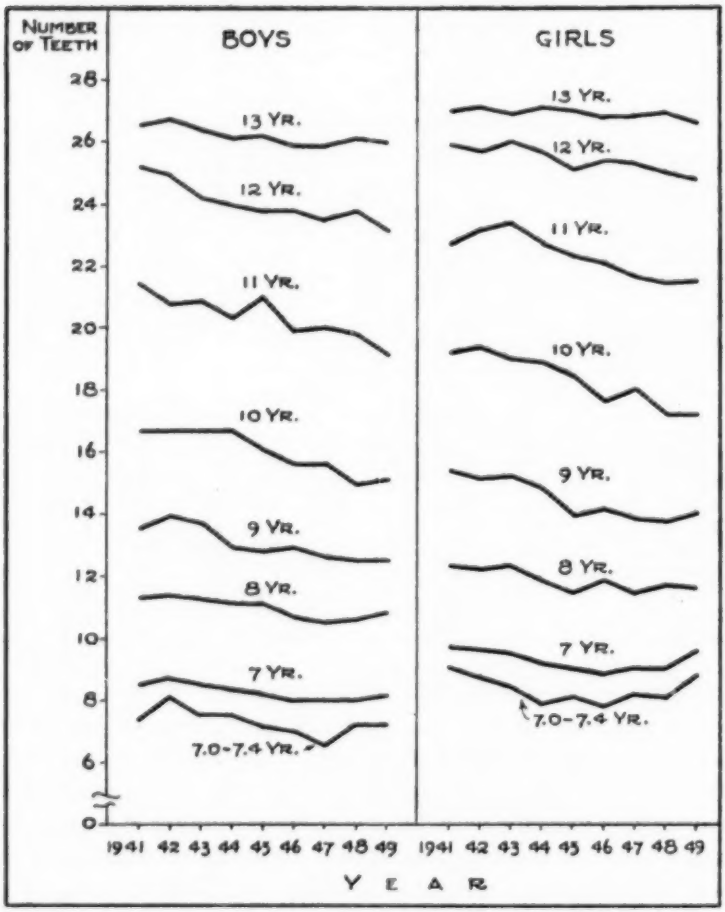


Fig. 1. Average number of erupted permanent teeth for boys and girls at ages 7 to 13 years examined in each school year from 1940–1941 to 1948–1949. At ages 9 to 13 years, averages are for combined populations of cities, villages, and Gjerpen; at 7 and 8 years, Gjerpen is excluded.

common findings. The maximum difference in the average number per child is found at age 10, with annual differences ranging from 2.0 to 2.7 teeth. At age 11, the sex difference is nearly as large, but is more variable. The maximum yearly increment of new teeth is found at 9 to 10 years of age for girls

and at 10 to 11 years for boys. This difference follows the normal sex difference.

In every single age group it is apparent in Figure 1 that the curves for boys as well as for girls are higher at the start of the period than at the end. The decrease is continuous throughout the period except for a few sex-age curves which have a tendency to rise a little at the end. The maximum decrease in average number of teeth is 11 per cent for boys at ages 10 and 11 years, and also for girls at ages 9 and 10 years. At 7.0 to 7.4 years, the change from the highest to lowest number of teeth is 19 per cent for boys and 13 per cent for girls (Gjerpen excluded), but for those aged 7.0 to 7.9 years, the decrease is about 9 per cent for both boys and girls.

At age 13 years, the maximum number of erupted teeth is 26.7 for boys and 27.1 for girls. This may seem low, but it compares well with other data on eruption. (Hurme 1948, Ekman 1938, Dahlberg and Maunsbach 1948–1950.)

The figures for Grue from 1943–1944 onward, correspond closely to those for the other groups with the exception of showing a greater decrease. (*See* Figure 5 and Table 7.)

The decrease in the number of erupted teeth during the period of study may be considered as a "delay" in eruption, and for the time being we will use that expression. In order to investigate this "delay" in detail the rate of eruption of the specific teeth has been studied.

Specific Permanent Teeth Erupted at Different Ages. The percentages of children with a specific permanent tooth erupted have been studied at ages around the average eruption time for the particular tooth. On account of small numbers of children examined and the few teeth erupted in some age groups, percentages for the different years of examination show somewhat irregular changes from year to year and do not give a clear picture of the time trends. Therefore, three-year moving averages have been used;[9] that means averages of three successive years

[9] The three-year moving averages for combined populations of cities and villages or of cities, villages, and Gjerpen are simple averages of the moving averages for each

(Continued on page 374)

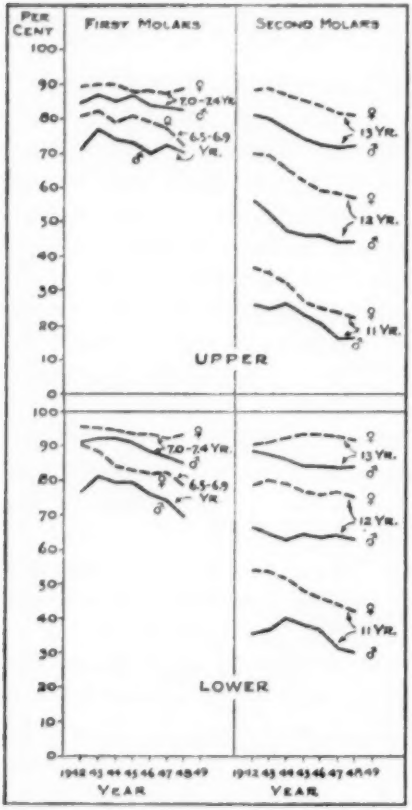


Fig. 2. Per cent of boys and girls with first molars erupted at 6.5 to 7.4 years and per cent with second molars erupted at 11 to 13 years of age. Three-year moving averages; cities and villages for first molars; cities, villages, and Gjerpen for second molars.

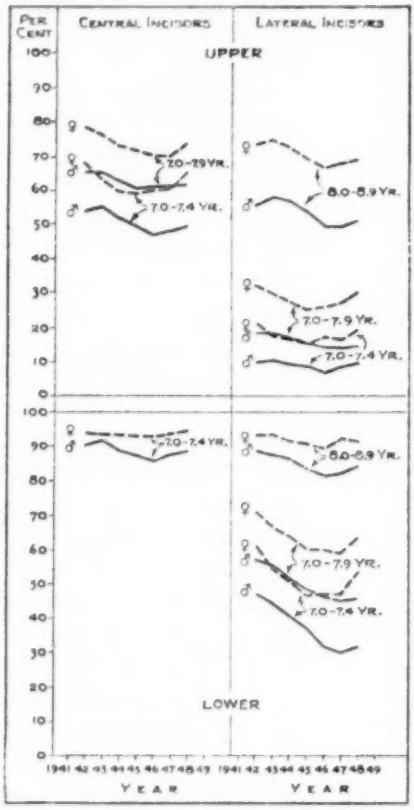


Fig. 3. Per cent of boys and of girls with permanent incisors erupted. Three-year moving averages for cities and villages.

are calculated, starting with the school years 1940–1941, 1941–1942 and 1942–1943 and then continuing with the years 1941–1942, 1942–1943 and 1943–1944, and so on. These averages tend to minimize the changes observed and limit the possibility of detailed studies of the yearly changes, but, on the other hand,

community group. In a few instances, these averages of values for the separate community groups differ slightly from the percentages for three-year periods shown in Table 5 which are computed on the combined population for the communities.

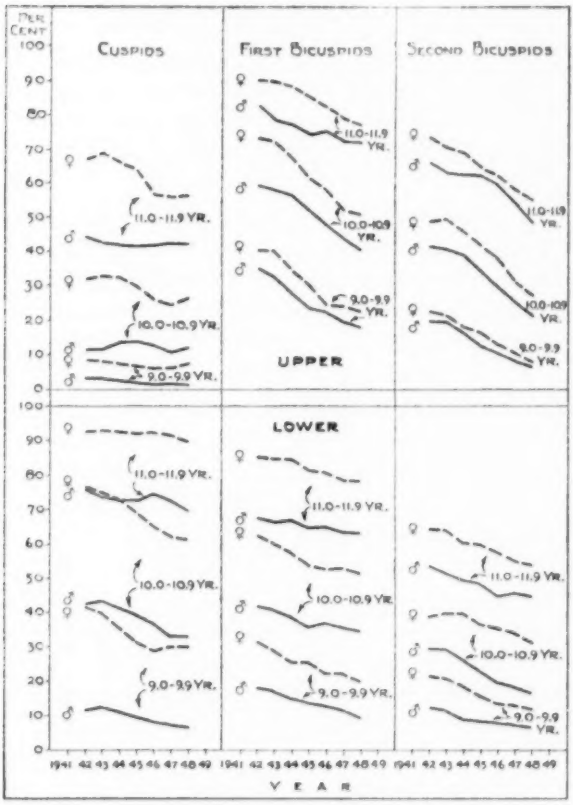


Fig. 4. Per cent of boys and of girls with permanent cuspids and bicuspids erupted at ages 9 to 11 years. Three-year moving averages for cities, villages, and Gjerpen.

the smoother curves give a clearer picture of the changes within the period 1941 to 1949.

For the first molars and incisors, data for cities and villages are combined; and for selected ages from 6.5[10] to 8 years percentages are shown in Figure 2 and Figure 3. Similarly, trends in eruption of the second molars are shown in Figure 2 for children aged 11, 12, and 13 years for cities, villages, and Gjerpen combined.

In Table 5, for selected sex-age groups, the percentages of children with a particular tooth erupted are given for three periods of three school years. Significance of the variation in percentages for the three periods has been tested by the method of Chi square. The Chi square value and the probability of the observed or a greater variation occurring as a result of chance fluctuation are given in Table

[10] Children aged 6 years would be most suitable to study eruption of first molars. The small group aged 6.5–6.9 years available for cities and villages, therefore, have been included.

Table 5. Changes observed in the eruption status of specified permanent teeth at selected chronological ages for boys and girls examined in combined Norwegian community groups, by three school year periods of examination.

Specific Tooth and Age at Examination	Boys					Girls				
	Per Cent With Tooth Erupted In Specified Three-Year Period			Significance of Differences		Per Cent With Tooth Erupted In Specified Three-Year Period			Significance of Differences	
	1941–1943	1944–1946	1947–1949	X^2	P	1941–1943	1944–1946	1947–1949	X^2	P
First Molar[1]										
Upper:										
6.5–6.9 Years	68.8	73.1	70.2	0.8	>.50	81.9	80.4	72.2	5.5	>.05
7.0–7.4	85.2	87.0	83.7	2.6	>.20	89.3	88.3	88.6	0.6	>.70
Lower:										
6.5–6.9	75.9	79.3	68.6	6.0	.05	90.6	83.4	78.4	9.7	<.01
7.0–7.4	91.2	90.6	85.4	10.6	<.01	95.4	93.7	93.4	3.0	>.20
Central Incisor[1]										
Upper:										
7.0–7.4	54.4	49.5	49.5	3.4	>.10	68.4	58.9	65.3	10.3	<.01
7.0–7.9	65.6	60.2	61.6	6.9	.02–.05	78.5	71.3	72.9	15.9	<.001
Lateral Incisor[1]										
Upper:										
7.0–7.9	17.9	14.8	14.3	6.0	.02–.05	31.9	25.2	30.9	12.5	<.01
8.0–8.9	55.9	53.1	50.2	6.3	.02–.05	73.5	69.1	68.4	6.4	.02–.05
Lower:										
7.0–7.4	47.4	36.3	32.1	27.1	<.001	61.9	46.8	53.9	24.2	<.001
7.0–7.9	57.1	48.1	45.9	30.7	<.001	71.0	60.0	63.4	29.7	<.001
Cuspid[2]										
Upper:										
10.0–10.9	11.9	13.4	11.9	0.7	>.50	32.4	29.5	28.4	1.7	>.30
11.0–11.9	44.8	41.5	42.3	1.3	>.50	63.8	63.0	57.0	5.7	>.05
12.0–12.9	76.3	69.3	68.2	16.7	<.001	86.3	83.6	81.7	7.2	.02–.05
Lower:										
9.0–9.9	12.0	8.9	6.6	11.1	<.01	41.6	30.1	29.7	23.9	<.001
10.0–10.9	42.5	39.0	33.1	9.0	.01–.02	76.2	69.0	64.1	14.6	<.001
11.0–11.9	76.3	72.6	69.2	6.2	.02–.05	93.6	91.8	89.2	6.0	.05
First Bicuspid[2]										
Upper:										
9.0–9.9	32.3	23.3	17.8	36.6	<.001	40.4	30.8	22.8	42.0	<.001
10.0–10.9	56.9	51.7	39.9	28.5	<.001	71.5	61.6	52.6	32.3	<.001
11.0–11.9	83.4	73.9	71.6	21.6	<.001	88.2	85.1	78.2	18.6	<.001
Lower:										
9.0–9.9	18.8	13.0	9.3	24.5	<.001	31.4	25.0	19.7	20.9	<.001
10.0–10.9	43.1	35.3	33.7	10.1	<.01	62.8	53.2	52.8	11.1	<.01
11.0–11.9	68.4	64.3	62.9	3.6	>.10	86.0	80.8	78.2	10.0	<.01
Second Bicuspid[2]										
Upper:										
9.0–9.9	19.5	12.9	6.9	44.7	<.001	22.6	17.1	7.9	48.0	<.001
10.0–10.9	41.6	33.4	20.6	48.6	<.001	49.1	42.0	27.1	46.0	<.001
11.0–11.9	67.5	62.5	47.6	44.6	<.001	72.0	64.2	54.9	29.7	<.001
Lower:										
9.0–9.9	13.2	8.1	6.3	18.9	<.001	20.6	15.4	11.8	17.1	<.001
10.0–10.9	30.3	22.8	16.3	26.2	<.001	40.9	36.5	30.3	10.6	<.01
11.0–11.9	52.5	47.5	44.8	6.1	.02–.05	65.6	59.9	55.1	10.4	<.01
Second Molar[2]										
Upper:										
11.0–11.9	26.6	23.0	15.7	17.9	<.001	35.3	27.2	22.5	19.3	<.001
12.0–12.9	58.1	48.0	45.0	34.2	<.001	70.5	62.9	57.8	30.3	<.001
13.0–13.9	81.2	75.3	72.8	21.0	<.001	88.3	85.2	82.7	12.9	<.01
Lower:										
11.0–11.9	36.7	37.9	29.4	9.4	<.01	53.1	47.6	41.2	13.2	<.01
12.0–12.9	67.7	64.2	62.0	6.7	.02–.05	78.6	76.1	75.9	2.4	>.20
13.0–13.9	88.2	84.5	84.2	8.4	.01–.02	89.7	93.1	92.4	—	—

[1] Combined data for cities and villages excluding Gjerpen.
[2] Combined data for cities and villages *including* Gjerpen.

5. The arbitrary division of the nine school years into three-year periods does not always measure the maximum change in eruption rate shown in the charts. This is especially true if the rate increased in the last one or two years after a low in 1946 or 1947.

First Permanent Molars. The mean ages of emergence for upper and lower first molars for boys and for girls are 5.9–6.4 years, according to Hurme. Figure 2 shows a definite decline in percentage of boys and of girls with this tooth erupted at ages 6.5–6.9 years both in the upper and lower jaw, more pronounced in the lower. The X^2 test for change in eruption of lower first molars is significant for girls, and borderline $P = .05$ for boys at age 6.5–6.9 years; it is significant for boys at age 7.0–7.4 but not for girls, nearly all of whom had their lower first molars at this age. Changes in eruption of upper first molars were not statistically significant.

Central Incisors. The percentages of children having their central incisors at age 7 years are shown in Figure 3 and Table 5. The mean ages of emergence (Hurme) are from 6.3 to 7.5 years. At 7.0–7.4 years and at 7.0–7.9 years of age, both boys and girls in the cities and villages clearly show a reduction in the eruption rate in the upper jaw and a tendency for the rate to rise at the end of the period. The Chi square test is significant at age 7.0–7.9 for both boys and girls and is significant for girls at 7.0–7.4 years. In the lower jaw, the central incisors were erupted in about 90 per cent of the children. At age 7.0–7.4 years, boys show a decrease in eruption followed by some increase, but there is little variation for girls.

Lateral Incisors. Trends in the eruption of the lateral incisors are shown in Figure 3 for children aged 7 and 8 years. The mean ages of emergence (Hurme) are 7.3–8.7 years. There is a significant reduction in the eruption rates for both lower and upper lateral incisors. As noted for the central incisors, an increase in eruption rates is indicated at the end of the period.

In Grue, a rural community, a large and significant reduction in the eruption of the upper lateral incisor is found for 8 year

old boys and girls for the three years, 1947–1949 as compared with 1944–1946. (*See* Table 6.)

Table 6. GRUE: Changes observed in the eruption status of specific permanent teeth at selected chronological ages for boys and girls by 3 school-year periods of examination, 1944–1949.

Specific Tooth and Age at Examination	Boys				Girls			
	Per Cent With Tooth Erupted in 3-Year Periods		Significance of Difference		Per Cent With Tooth Erupted in 3-Year Periods		Significance of Difference	
	1944–1946	1947–1949	X^2	P	1944–1946	1947–1949	X^2	P
Lateral Incisor								
Upper:								
8.0–8.9 Years	54.8	36.7	7.9	<.01	72.4	54.6	8.9	<.01
Lower:								
8.0–8.9	83.0	73.4	3.2	>.05	88.6	84.4	1.1	>.20
Cuspid								
Upper:								
11.0–11.9	45.8	36.5	2.2	>.10	71.8	61.4	2.7	>.05
Lower:								
10.0–10.9	42.3	29.6	4.3	.02–.05	80.3	59.1	13.1	<.001
First Bicuspid								
Upper:								
10.0–10.9	57.0	36.1	11.0	<.001	65.0	46.7	8.1	<.01
Lower:								
10.0–10.9	39.6	31.5	1.8	>.10	69.3	45.7	13.7	<.001
11.0–11.9	68.1	58.9	2.3	>.10	84.7	74.3	3.8	>.05
Second Bicuspid								
Upper:								
10.0–10.9	43.0	14.8	23.1	<.001	38.0	21.0	8.1	<.01
Lower:								
10.0–10.9	29.5	21.3	2.2	>.10	51.1	33.3	7.6	<.01
11.0–11.9	52.8	41.1	3.3	>.05	71.8	56.4	5.7	.01–.02
Second Molar								
Upper:								
11.0–11.9	26.4	21.5	0.8	>.30	40.3	18.8	12.1	<.001
12.0–12.9	53.9	42.0	3.5	>.05	68.0	53.6	5.2	.02–.05
Lower:								
11.0–11.9	44.4	35.5	2.0	>.10	64.5	40.6	12.8	<.001
12.0–12.9	64.5	57.1	1.5	>.20	85.2	73.6	4.9	.02–.05
Number of Children								
8.0– 8.9	135	109			123	141		
9.0– 9.9	130	107			134	120		
10.0–10.9	149	108			137	105		
11.0–11.9	144	107			124	101		
12.0–12.9	141	112			128	110		
13.0–13.9	128	116			138	113		

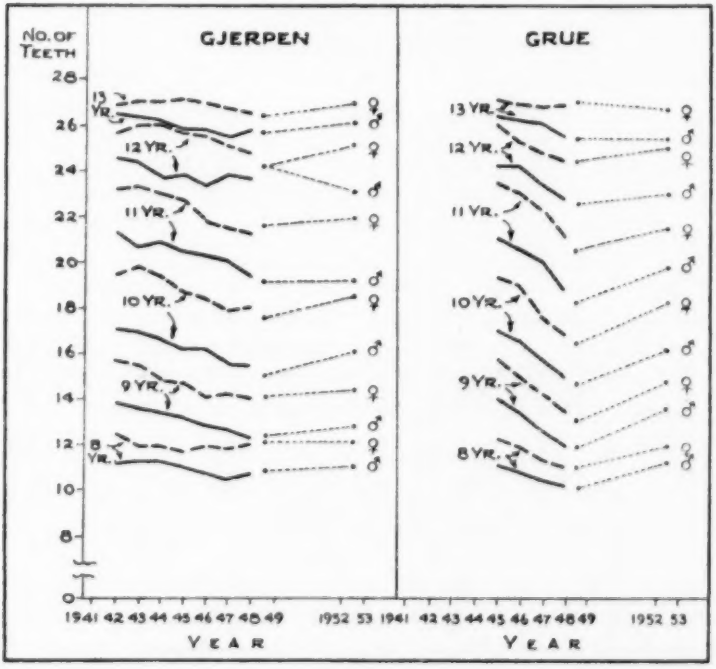
Cuspids and Bicuspids. Percentages of children with the cuspids, the first and second bicuspids erupted are shown in Figure 4 for ages 9, 10, and 11 years.

The mean ages of emergence (Hurme) of the cuspids are 9.9 to 11.7 years; of the first bicuspids are 10.0–10.8 years; and of the second bicuspids are 10.9–11.5 years.

For the cuspids, the decrease in eruption rates is significant for the lower jaw at ages 9, 10, and 11 years for boys, and at ages 9 and 10 years for girls; but for the upper jaw change in eruption is not significant for either boys or girls at ages 10 and 11 years. At age 12 years (Table 5), there is a significant reduction in eruption of upper cuspids for both boys and girls.

For boys and for girls there is a very significant decrease in

Fig. 5. Average number of erupted permanent teeth for children in Gjerpen and in Grue at ages 8 to 13 years. Three-year moving averages first period to 1949; two-year averages 1948–1949 and 1952–1953.



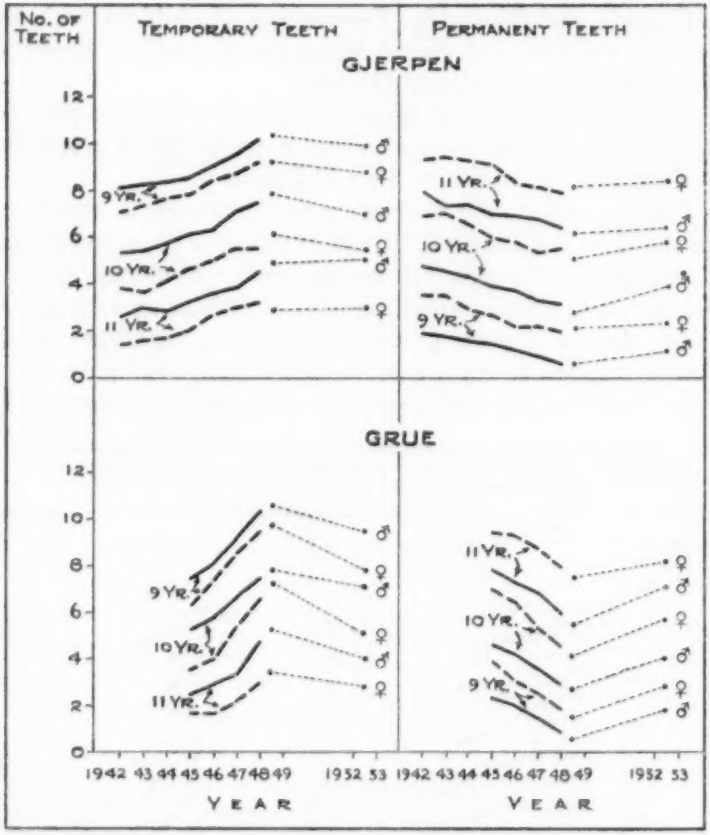


Fig. 6. Average number of permanent cuspids and bicuspids per child and average number of deciduous cuspids and molars (teeth numbers 3, 4 and 5) for children aged 9, 10 and 11 years in Gjerpen and Grue. Three-year moving averages to 1949; two-year averages 1948–1949 and 1952–1953.

the eruption rates for upper and lower first and second bicuspids at ages 9, 10, and 11 years with the exception of rates for lower bicuspids at age 11 years for boys.

Grue demonstrates the same picture for cuspids and bicuspids. (Table 6 and Figure 6.) Cuspids and first and second bicuspids in both jaws show a marked reduction in 9, 10, and 11 year old boys and girls. At age 10, the reduction is statistically

significant for eruption rates in the upper jaw for boys and girls for both bicuspids; eruption rates in the lower jaw decreased significantly for girls for cuspids and bicuspids, and for boys only for cuspids. (Table 6.)

Second Molars. The mean ages for emergence of the second molars are from 11.7 to 12.7 years. Trends in eruption rates for the combined population examined in cities, villages, and Gjerpen are shown in Figure 2. For boys and for girls at ages 11, 12, and 13 years, eruption rates for upper second molars decreased very significantly. There is a significant reduction for boys also in the lower jaw at these ages; but for girls, a significant delay is indicated only at age 11.

Also in Grue there was a decrease in the eruption rate for the second molars in the years 1947–1949 as compared with 1944–1946. This decrease was statistically significant for girls at ages 11 and 12 years but not for boys.

Summary. For the first period of study, 1940–1941 to 1948–1949, data on the eruption of permanent teeth give evidence for the following general conclusions:

1. At each age from 7 to 13 years, girls show a higher eruption rate than boys. This pertains to the average number of teeth erupted and to the percentage of children with any specific tooth erupted.

2. A decrease in the average number of permanent teeth erupted occurred during the period at every age from 7 to 13 years. However, at age 13 years when most of the twenty-eight teeth are erupted, the decrease was slight, especially for girls.

3. The decrease in the average number of teeth starts in 1942–1943 or the following year, and at most ages the greater part of the decrease has occurred by 1945–1946 or 1946-1947. At the younger ages, 7 and 8 year olds, the average eruption rates for 1947–1948 and 1948–1949 suggest some reversal of the decrease.

4. Some "delay" in emergence of every specific tooth is indicated by the percentages of children with a specific tooth erupted at ages around the normal eruption time. In all the districts

studied, the decrease in eruption rates at specific ages is very pronounced for cuspids, bicuspids, and second molars.

5. The annual eruption rates for the different teeth show, in many instances, a rise during the later years of the period after having decreased for several years. The significance of this will be discussed later.

Eruption of Permanent teeth 1951–1952 and 1952–1953 Compared with Earlier Period 1941–1949

Total Permanent Teeth Erupted. In Gjerpen, children at all ages were examined during the second period and can be compared with corresponding ages during the entire first period. Children in Grue also were examined in the second period and are comparable with those examined during the period 1943–1944 to 1948–1949. For these two separate communities, the average eruption rates for permanent teeth for each sex-age group in the two years 1952 and 1953 are shown in Figure 5 and compared with averages for the two-year period 1948 and 1949. The three-year moving averages for the first period of study also are plotted in Figure 5. Annual rates for Gjerpen are given in Table 2-b and for Grue in Table 7.

In Gjerpen, for the two years 1952 and 1953 combined, the average number of permanent teeth erupted is higher than or equal to the averages for corresponding sex-age groups for the years 1948 and 1949 combined, with the exception of 12 year old boys who show a decrease.[11] The greatest increase is found for 10 year old children. Values for the second period have not risen to the rates for the earliest years except in the case of 13 year old girls who show very little change throughout the two periods of study.

In Grue, all ages from 8 to 12 years demonstrate a definite increase in the number of permanent teeth in the years 1952 and

[11] As shown in Table 2-b, the number of erupted permanent teeth for 12 year old boys in the year 1948, is much higher than in the previous or following year and also shows an excessive increase in the number of new teeth from age 11 in 1947 to age 12 in 1948. Examination of records suggests that there may have been some failure to mark cuspids and bicuspids as not erupted. However, the decrease in 1951–1952 and 1952–1953 also is the result of a continuing decrease in the eruption rate for second molars among the 12 year old boys (Table 8).

School Year	Boys of Specified Age						Girls of Specified Age					
	8	9	10	11	12	13	8	9	10	11	12	13
	Average number of erupted permanent teeth											
1943–44	11.3	13.6	16.9	22.0	23.6	26.6	11.8	16.8	19.1	23.3	26.6	27.2
1944–45	11.2	14.1	16.7	20.4	25.1	26.0	12.7	15.1	20.5	22.8	25.6	27.3
1945–46	10.9	14.2	17.6	20.9	24.0	26.7	12.1	15.6	18.7	24.4	25.5	26.9
1946–47	10.3	11.9	15.5	20.4	23.2	25.9	10.9	14.2	17.7	22.2	24.6	26.6
1947–48	9.9	11.8	14.3	18.9	23.0	25.7	10.9	13.0	16.5	20.2	24.2	26.9
1948–49	10.3	12.2	15.0	17.1	22.0	25.0	11.3	13.3	16.5	20.9	24.9	27.1
1951–52	11.4	13.4	15.4	19.7	23.2	25.3	12.0	14.3	18.1	20.7	25.3	26.5
1952–53	11.1	13.7	16.6	20.0	23.0	25.6	11.8	15.2	18.5	22.1	24.8	26.9
	Number of children											
1943–44	45	43	53	43	46	40	49	45	45	40	42	56
1944–45	45	45	46	56	41	45	40	49	46	40	42	40
1945–46	45	42	50	45	54	43	34	40	46	44	44	42
1946–47	48	40	40	50	44	48	61	35	38	43	45	45
1947–48	30	42	39	36	44	44	52	53	32	36	39	38
1948–49	31	25	29	21	24	24	28	32	35	22	26	30
1951–52	61	54	39	47	38	44	49	42	61	39	64	50
1952–53	62	56	54	38	45	38	62	45	43	60	40	59

Table 7. Grue: Average number of erupted permanent teeth per child at ages 8 to 13 years for boys and girls 1943–1944 to 1948–1949, and 1951–1952 and 1952–1953.

1953 compared with 1948 and 1949 (Table 7). The greatest increases are shown at ages 9, 10, and 11 years. At age 13 years, neither boys nor girls had an increase in the erupted permanent teeth in the later period.

Eruption of Specific Teeth. At ages 9, 10, and 11 years, when the greatest changes in total erupted permanent teeth are indicated, the cuspids (No. 3), first bicuspids (No. 4), and second bicuspids (No. 5) are emerging. In Figure 6 and Table 8 changes in the numbers of these teeth erupted are shown for Gjerpen and Grue. For the most part, in both districts, changes are very similar to changes in the total number of permanent teeth erupted at these ages. This is to be expected since the cuspids and bicuspids account for nearly all the new permanent teeth.

In Gjerpen, increases between 1948–1949 and 1952–1953 in

Table 8. Permanent cuspids and bicuspids erupted at ages 9, 10, 11 years and second molars at ages 11, 12, 13 years for boys and girls examined in cities, Gjerpen, and Grue 1951–1952 and 1952–1953 compared with earlier period 1941–1949.

School-Year Periods and Community Group	Boys of Specified Age						Girls of Specified Age					
	Teeth Nos. 3 + 4 + 5			2nd Molars			Teeth Nos. 3 + 4 + 5			2nd Molars		
	9	10	11	11	12	13	9	10	11	11	12	13
	AVERAGE NUMBER ERUPTED PER CHILD											
Reduced Cities[1]												
3-Year Average												
1941–43	2.3	4.4	7.1	1.0	2.7	3.5	2.5	6.4	9.5	1.9	3.2	3.6
1944–46	1.0	4.0	7.5	0.9	2.1	3.3	2.1	5.0	8.8	1.4	2.9	3.6
1947–49	0.9	3.2	6.9	1.0	2.3	3.2	1.8	4.3	8.3	1.5	2.8	3.6
2-Year Average												
1948–49	0.9	3.1	6.9	0.9	2.3	3.3	1.9	4.5	7.7	1.2	2.9	3.6
1952–53	1.4	4.0	6.4	0.6	1.9	3.1	2.2	5.6	8.2	1.6	3.1	3.6
Gjerpen												
3-Year Average												
1941–43	2.0	4.8	8.1	1.3	2.3	3.3	3.7	7.0	9.4	1.7	2.8	3.6
1944–46	1.6	4.0	7.1	1.4	2.3	3.1	2.8	6.1	9.2	1.6	2.9	3.6
1947–49	0.7	3.2	6.4	0.9	2.3	3.1	2.0	5.5	8.0	1.2	2.7	3.3
2-Year Average												
1948–49	0.7	2.9	6.2	0.9	2.4	3.1	2.2	5.2	8.4	1.2	2.4	3.3
1952–53	1.1	4.0	6.5	0.7	1.9	3.3	2.4	5.9	8.4	1.5	2.6	3.6
Grue												
3-Year Average												
1944–46	2.3	4.6	7.8	1.4	2.4	3.3	3.8	6.9	9.4	2.1	3.1	3.8
1947–49	0.8	2.9	5.8	1.1	2.0	3.0	1.8	4.5	7.9	1.2	2.6	3.5
2-Year Average												
1948–49	0.6	2.7	5.4	0.9	2.1	2.9	1.5	4.1	7.4	1.0	2.5	3.6
1952–53	1.8	4.0	7.1	0.9	1.8	2.9	2.8	5.7	8.2	1.4	2.8	3.5
	NUMBER OF CHILDREN EXAMINED											
Reduced Cities												
1941–43	93	73	69	69	285	283	94	74	71	71	244	268
1944–46	154	87	99	99	299	454	107	77	76	76	299	458
1947–49	153	92	105	105	270	460	139	75	81	81	281	411
1948–49	108	56	72	72	161	320	90	55	53	53	177	285
1952–53	118	53	62	62	239	319	98	59	75	75	284	308
Gjerpen												
1941–43	191	182	205	205	198	221	165	179	194	194	213	243
1944–46	174	192	195	195	196	200	146	152	160	160	186	193
1947–49	220	191	177	177	186	188	198	177	155	155	155	143
1948–49	156	137	117	117	125	116	131	136	108	108	98	91
1952–53	155	139	115	115	184	169	141	135	129	129	151	136
Grue												
1944–46	130	149	144	144	141	128	134	137	124	124	128	138
1947–49	107	108	107	107	112	116	120	105	101	101	110	113
1948–49	67	68	57	57	68	68	85	67	58	58	65	68
1952–53	110	93	85	85	83	82	87	104	99	99	104	109

[1] At ages 9, 10 and 11 years includes 3 cities; at ages 12 and 13 years includes 5 cities.

the average numbers of permanent cuspids and bicuspids erupted ranged from no increase at age 11 to 0.7 teeth at age 10 years for girls, and from 0.3 at age 11 to 1.1 at age 10 years for boys. These increases were less than the previous decreases, and, except for boys aged 10 years, eruption rates were lower in 1952–1953 than in the three-year period 1944–1946 for both boys and girls aged 9 to 11 years.

In Grue, eruption of permanent cuspids and bicuspids increased between 1948–1949 and 1952–1953 more than in Gjerpen. For girls, increases in average numbers erupted at ages 9, 10 and 11 years ranged from 0.8 teeth at age 11 to 1.6 at age 10 years; and for boys, increases ranged from 1.2 at age 9 to 1.7 at age 11 years. The greater increases in Grue than in Gjerpen followed larger reductions in Grue than in Gjerpen. Eruption figures for Grue at ages 9 to 11 years for both sexes were lower in 1952–1953 than for the period 1944–1946.

It is of interest that, in Grue, the eruption of lateral incisors, especially in the upper jaw, increased greatly among 8 year old boys and girls in 1952–1953. In this later two-year period, 59 per cent of the boys and 73 per cent of the girls had their upper permanent lateral incisors compared with 38 per cent and 53 per cent, respectively, in 1948–1949. In fact, the eruption of upper lateral incisors had reached the level found for the years 1944 and 1945, 57 and 74 per cent for 8 year old boys and girls, respectively.

Examinations in 1952 and 1953 were available for children aged 9, 10, and 11 years in three of the cities included in the combined city group studied for the earlier period. For this reduced city group, the average numbers of permanent cuspids and bicuspids are compared for the two periods in Table 8. Although the numbers of children in each sex-age group are small and the population is more heterogeneous than in the single community groups of Gjerpen and Grue, the pattern of change is very similar and an increase in the eruption rates for cuspids and bicuspids in 1952 and 1953 over rates for the two years 1948 and 1949 is found for each sex-age group except boys aged 11.

The eruption of second molars at ages 11, 12, and 13 years in the later and earlier periods is shown in Table 8 for Gjerpen, Grue, and for the reduced cities.[12] The pattern of change from 1948 and 1949 to 1952 and 1953 is similar for the three community groups but differs by sex and age. At ages 11 and 12, for boys, the average number of second molars erupted was less in the later period or showed no change. At age 13, the change for boys was not consistent and was too small to indicate any real change in the number of second molars. Girls in all districts had a small increase in the number of erupted second molars at ages 11 and 12 years, and at age 13, as for boys, there was little or no change.

The sex difference in the changes in eruption of second molars between the periods 1948–1949 and 1952–1953 at ages 11 and 12 years can be related to the pattern of eruption of all teeth when this is examined on a longitudinal or cohort basis, *i.e.*, following a group progressively from one age to the next in successsive years. For example, children aged 12 in 1952 and 1953 were 8 years of age in 1948 and 1949, the years in which reversal of the "delay" in eruption began to appear at the younger ages. An increased eruption of cuspids and bicuspids at ages 9, 10, and 11 has been noted for both boys and girls between 1948 and 1949 and 1952 and 1953. The accelerated eruption of teeth is demonstrated by a comparison of the increment in the average total permanent teeth between ages 8 and 12 years in the two four-year intervals from the school year 1944–1945 to 1948–1949, and 1948–1949 to 1952–1953. In Grue, for boys, the four-year increments were 11.2 and 13 teeth; for girls, the increments were 12.3 and 14 teeth in the two four-year periods, respectively. Thus, between age 8 and 12 years, both boys and girls, on the average, had gained nearly two teeth more in the later four-year period than in the earlier period. This "catching-up" process in boys was concentrated in the cuspids and bicuspids which normally emerge at 9 to 11 years but did not extend to the second

[12] At ages 12 and 13 only one city (Tromsö) included in the analysis of the 1941 to 1949 period was not available for the years 1951–1952 and 1952–1953.

molars at 11 and 12 years. In girls, however, "normal" age for emergence of second molars is younger and the accelerated rate of eruption did affect the emergence of second molars at age 11 and 12 years.[13] This suggests that reversal of delay in eruption of specific teeth from 1949 to 1953 progressed by age according to the normal tooth eruption sequence with the effect on different teeth becoming evident when children who had had time to make up the delay in earlier teeth had reached the age at which the specific tooth normally erupts.

Changes in the Number of Deciduous Cuspids and Molars Present at Ages 7 to 11 Years

The presence of the deciduous cuspids and molars (teeth numbers 3, 4, and 5) has been studied in the combined cities, and villages,[14] in Gjerpen and in the rural community, Grue.

Changes at Ages 9, 10, and 11 Years. The average numbers of deciduous cuspids plus molars present at ages 9, 10, and 11 are shown in Table 9 for each community group by three-year periods in the earlier years, 1941–1949. All groups have the characteristic of a marked increase in the number of teeth present. Most of the increase occurred in the last three years for nearly all the specific sex-age groups in each of the separate districts. The upward trend began earlier but annual averages in the separate districts were too variable to give a clear indication of the school-year in which the rise started. Although the averages for cities, villages, and Gjerpen differed to some extent, and the numbers of teeth present were generally lowest in cities and highest in Gjerpen, data for these three community groups have

[13] Longitudinal or cohort analysis of these data will be presented in a later paper.

[14] At ages 9, 10, and 11 years, it has been necessary to use the reduced cities group (3 cities), both for the earlier period 1941 to 1949 and for the later two years 1952 and 1953, since deciduous teeth were not recorded as present for children in grades 3, 4, and 5 by examiners in Tromsö in the earlier period and no examinations were done in this City in the later period. For the combined village group, the presence of deciduous teeth at ages 9 to 11 years is studied for the earlier period only; at ages 7 and 8 years, a reduced village group has been used which excludes villages with examinations in the earlier period that did not furnish data for the later years, 1952 and 1953.

been combined[18] and annual averages are shown in Figure 7. The trend lines for each sex-age group are irregular but all show a definite upward trend in the latter part of the nine-year period. During the first three or four years the curves remain about level or show a slight downward trend. From 1943 or 1944, the curves for boys and girls aged 9 and 10 years rise rapidly; from the minimum value to the maximum, the increase is 2.7 teeth for boys and 2.9 for girls at age 9, and at age 10 the increases are 2.4 and 2.9. At age 11 years, the maximum increase is 2.4 teeth for boys, but only 1.5 for girls who are close to the end of the normal shedding period.

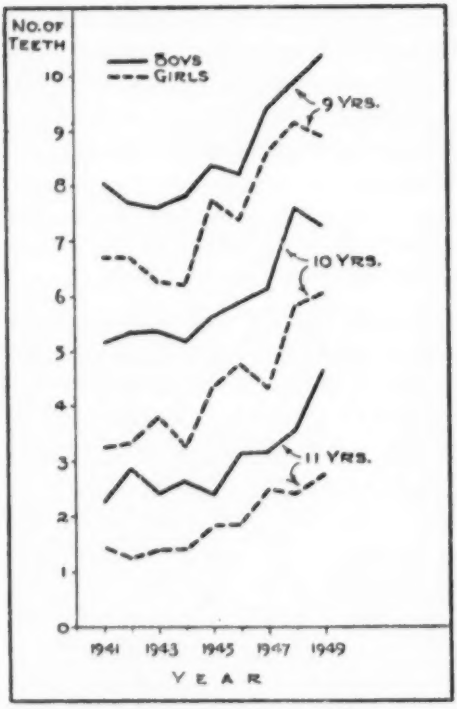


Fig. 7. Average number of deciduous cuspids and molars present at ages 9 to 11 years for boys and girls in three cities, villages, and Gjerpen, each year 1941–1949.

By 1952 and 1953, some decrease in the numbers of deciduous teeth had taken place at ages 9 and 10 years for both boys and girls in the reduced city group and in Gjerpen and Grue (Table 9). However, at age 11 years, changes from the average numbers of teeth present for 1948 and 1949 are not consistent. A small additional increase occurred among boys in cities and in

[18] Averages in Figure 7 are computed for combined populations. Populations from the different districts varied from year to year, but weighted annual averages based on a constant percentage from each district differed from the unweighted averages less than 0.2 tooth except in a very few instances.

School Years	Boys				Girls			
	3 Cities	Villages	Gjerpen	Grue	3 Cities	Villages	Gjerpen	Grue
	AGE 9 YEARS							
3-Year Average								
1941–43	7.0	7.7	8.1	—	6.6	6.1	7.1	—
1944–46	8.3	7.8	8.5	7.4	7.2	6.6	7.8	6.3
1947–49	9.8	9.7	10.2	10.2	8.9	8.6	9.2	9.6
2-Year Average								
1948–49	10.0	—	10.4	10.6	8.8	—	9.2	9.8
1952–53	8.7	—	9.9	9.5	8.3	—	8.8	7.9
	AGE 10 YEARS							
3-Year Average								
1941–43	5.0	5.4	5.3	—	2.9	3.5	3.7	—
1944–46	5.0	5.4	6.1	5.3	4.2	3.7	4.6	3.6
1947–49	6.2	6.9	7.5	7.4	5.8	5.4	5.6	6.6
2-Year Average								
1948–49	6.6	—	7.9	7.8	5.8	—	6.1	7.3
1952–53	6.2	—	7.0	7.1	5.3	—	5.5	5.1
	AGE 11 YEARS							
3-Year Average								
1941–43	2.6	2.4	2.6	—	0.9	1.5	1.4	—
1944–46	2.1	2.5	3.3	2.5	1.6	1.5	2.0	1.6
1947–49	3.4	3.4	4.5	4.4	2.4	2.2	3.2	2.8
2-Year Average								
1948–49	3.6	—	4.9	5.3	2.8	—	2.9	3.5
1952–53	4.2	—	5.1	4.0	2.5	—	3.0	2.9

Table 9. Deciduous cuspids and molars. Average number per child present at examination for boys and girls aged 9, 10 and 11 years in three cities, villages, Gjerpen and Grue.

Gjerpen, but among girls in cities there is a slight decrease and in Gjerpen almost no change. In Grue, both boys and girls aged 11 years show a decrease in the number of deciduous teeth.

Changes at Ages 7 and 8 Years. For children aged 7 and 8 years, the percentages with each of the deciduous cuspids and molars present (right side) at examination are shown in Tables 10a and 10b for the reduced city group, reduced village group, and Gjerpen. Three-year moving averages for the combined groups are plotted in Figure 8 which also shows average per-

Table 10a. Deciduous cuspids and molars present at ages 7 and 8 years. Per cent of boys with specified tooth present at examination in the years 1941–1949 and in 1952–1953.

Community Groups[1]	Age 7 Years					Age 8 Years				
	3-Year Average			2-Yr. Average		3-Year Average			2-Yr. Average	
	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953
	TOOTH NUMBER 3—UPPER									
4 Cities	97.3	99.4	100.0	100.0	100.0	93.3	96.4	98.5	99.3	97.3
3 Villages	98.8	99.1	99.1	99.1	99.7	93.0	96.2	98.7	98.1	98.6
Gjerpen	99.4	98.7	99.4	99.1	99.5	98.4	97.0	98.6	99.3	99.4
Combined Gps.	98.5	99.1	99.5	99.6	99.8	94.9	96.5	98.6	98.9	98.2
	TOOTH NUMBER 3—LOWER									
4 Cities	97.7	97.5	98.3	98.8	98.7	93.5	95.5	97.2	96.5	95.2
3 Villages	97.6	98.0	99.4	99.1	98.3	91.1	93.5	96.4	95.6	93.4
Gjerpen	99.1	99.2	99.4	99.1	99.0	92.9	96.4	100.0	100.0	96.5
Combined Gps.	98.1	98.2	99.0	99.0	98.7	92.5	95.1	97.9	97.0	95.0
	TOOTH NUMBER 4—UPPER									
4 Cities	90.2	90.7	95.0	91.3	91.4	68.8	75.3	85.3	85.5	81.0
3 Villages	87.8	90.3	96.2	96.6	90.8	68.1	77.7	86.8	85.4	82.5
Gjerpen	95.2	95.6	98.8	98.2	96.6	83.6	78.2	94.2	95.7	86.1
Combined Gps.	91.1	92.2	96.0	94.3	92.4	73.5	77.1	88.8	87.7	82.7
	TOOTH NUMBER 4—LOWER									
4 Cities	81.4	87.4	93.5	93.2	87.1	67.0	70.2	87.3	89.4	77.0
3 Villages	89.3	89.2	98.3	97.9	91.5	70.6	79.7	90.4	93.7	85.8
Gjerpen	89.2	90.8	96.8	96.5	95.2	79.0	71.6	89.8	92.8	86.1
Combined Gps.	86.6	89.1	96.2	95.4	90.4	72.2	73.8	89.2	91.5	81.8
	TOOTH NUMBER 5—UPPER									
4 Cities	92.2	95.0	98.1	97.5	94.7	75.2	83.1	93.3	94.7	91.2
3 Villages	95.8	95.2	97.7	98.3	93.9	75.4	82.7	96.7	96.6	91.5
Gjerpen	97.3	96.1	98.9	99.1	99.0	88.9	83.4	95.7	96.4	94.2
Combined Gps.	95.1	95.4	98.2	98.1	95.4	79.8	83.1	95.2	95.7	92.0
	TOOTH NUMBER 5—LOWER									
4 Cities	74.9	83.2	96.2	96.6	86.8	55.2	58.4	84.8	86.9	73.7
3 Villages	83.5	85.1	96.8	97.4	89.1	62.8	73.1	92.2	94.7	88.7
Gjerpen	86.4	87.6	97.9	98.2	96.1	72.2	69.5	91.8	95.7	91.9
Combined Gps.	81.6	85.3	97.0	97.2	89.7	63.4	67.0	89.6	91.4	82.5
	NUMBER OF BOYS EXAMINED									
4 Cities	398	446	477	322	394	363	364	442	283	331
3 Villages	327	269	358	235	294	250	227	300	206	212
Gjerpen	146	158	188	114	207	190	168	207	138	173

[1] Percentages for the combined groups are unweighted averages of the percentages for the three specified community groups.

Table 10b. Deciduous cuspids and molars present at ages 7 and 8 years. Per cent of girls with specified tooth present at examination in the years 1941–1949 and in 1952–1953.

Community Groups[1]	Age 7 Years					Age 8 Years				
	3-Year Average			2-Yr. Average		3-Year Average			2-Yr. Average	
	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953
	TOOTH NUMBER 3—UPPER									
4 Cities	97.7	98.2	98.9	98.7	98.7	91.4	93.2	95.2	95.1	95.5
3 Villages	98.3	97.7	99.1	99.2	98.8	90.5	95.2	95.9	95.9	96.0
Gjerpen	99.2	97.5	98.4	99.1	100.0	94.6	90.2	94.1	93.9	96.0
Combined Gps.	98.4	97.8	98.8	98.9	99.0	92.2	92.9	95.1	95.1	95.8
	TOOTH NUMBER 3—LOWER									
4 Cities	96.6	95.8	98.3	98.1	94.4	83.0	89.4	88.0	85.2	86.9
3 Villages	97.7	99.0	98.5	97.9	96.0	82.2	89.8	86.9	87.2	86.5
Gjerpen	96.2	96.5	96.1	96.4	97.4	80.9	86.0	82.6	80.2	80.8
Combined Gps.	96.8	97.1	97.6	97.7	95.6	82.0	88.4	85.8	84.8	85.1
	TOOTH NUMBER 4—UPPER									
4 Cities	88.8	91.4	93.4	93.6	94.1	66.8	76.8	83.2	84.1	76.1
3 Villages	92.0	94.1	97.9	97.9	94.8	67.0	78.6	90.2	90.9	80.5
Gjerpen	96.5	94.0	97.2	97.3	96.3	77.2	80.1	82.4	82.4	89.8
Combined Gps.	92.4	93.2	96.2	95.8	94.8	70.3	78.5	85.3	86.1	81.1
	TOOTH NUMBER 4—LOWER									
4 Cities	86.1	88.8	95.1	95.9	89.5	65.8	67.3	83.1	83.0	77.2
3 Villages	88.8	93.2	97.1	97.0	90.3	67.6	77.7	87.6	89.5	84.0
Gjerpen	92.9	91.5	97.6	96.4	93.7	76.7	80.1	87.1	87.8	84.7
Combined Gps.	89.3	91.2	96.6	96.4	90.7	70.0	75.0	85.9	86.3	81.2
	TOOTH NUMBER 5—UPPER									
4 Cities	91.8	96.6	97.8	97.8	96.2	77.4	86.5	94.3	95.1	87.5
3 Villages	96.0	96.4	99.0	98.7	96.4	74.6	88.0	95.0	94.5	89.0
Gjerpen	97.3	96.3	98.3	98.2	100.0	88.6	90.3	91.6	91.6	94.9
Combined Gps.	95.0	96.4	98.4	98.2	97.2	80.2	88.3	93.6	94.2	89.9
	TOOTH NUMBER 5—LOWER									
4 Cities	76.4	80.7	92.0	93.3	86.1	46.3	55.1	81.1	83.0	66.8
3 Villages	83.5	85.9	94.9	97.0	90.3	56.1	70.3	87.0	89.0	84.5
Gjerpen	87.1	92.4	96.6	96.4	95.2	70.5	73.3	89.6	90.1	84.7
Combined Gps.	82.3	86.3	94.5	95.2	89.5	57.6	66.2	85.9	86.6	76.9
	NUMBER OF GIRLS EXAMINED									
4 Cities	393	372	453	314	373	337	317	396	283	289
3 Villages	353	269	338	236	248	263	250	319	219	200
Gjerpen	121	162	177	112	189	150	146	204	131	177

[1] Percentages for the combined groups are unweighted averages of the percentages for the three specified community groups.

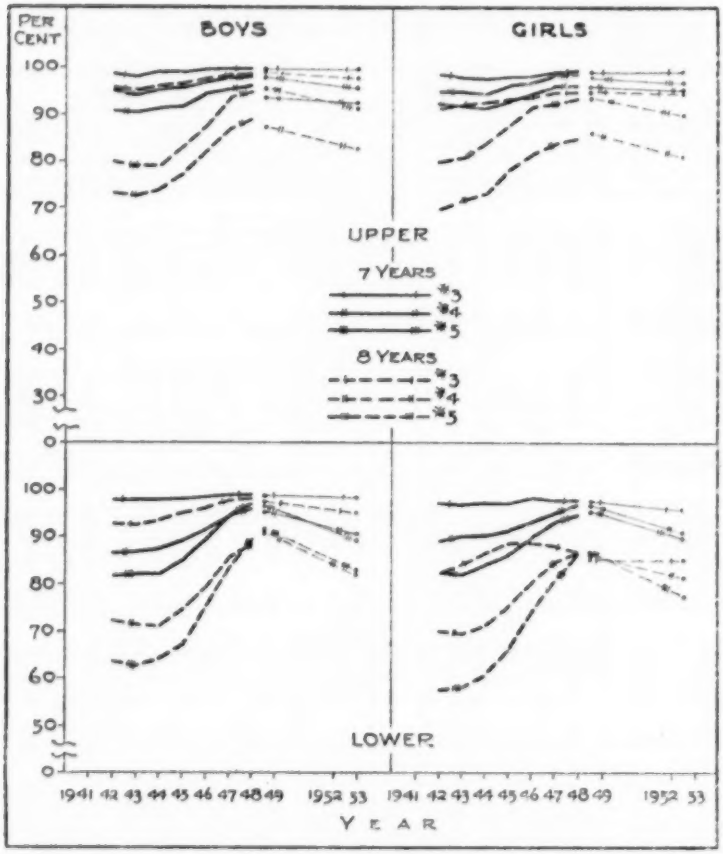


Fig. 8. Per cent of children with deciduous cuspids (number 3) and deciduous molars (numbers 4 and 5) present at ages 7 and 8 years for reduced city group, villages, and Gjerpen. Three-year moving averages 1941–1949; two-year averages 1948–1949 and 1952–1953.

centages for the later two-year period 1952 and 1953 and the two-year period 1948 and 1949. Although there are some differences among the three community groups in the percentages of teeth present, especially the deciduous molars, the patterns of change over the study period are very similar and the combined percentages in Figure 8 are representative of the time trends.

There is practically no difference between boys and girls in

the percentages of specific teeth present, as is evident in Figure 8. The only differences to be noted are slightly lower percentages for the cuspids and the upper first and lower second molars for girls than for boys.

The cuspids are present almost 100 per cent at age 7 years and thus do not show any changes. At 8 years of age, there is a slight increase in the percentages of children with cuspids present during the earlier period 1941–1949, and in the later two years 1952–1953 there is no real change from the values reached at the end of the earlier period.

Changes in the retention of deciduous molars are greater than those for the cuspids, and are especially large at 8 years of age. The upper molars in 7 year olds, present in more than 90 per cent at the start, show only a very small increase during the first period. In the lower jaw, the molars are present in a smaller percentage of 7 year old children, and a definite increase during the first period is indicated, followed by a decrease in the later two years. At 8 years of age, about 70 to 80 per cent of the children had their upper molars at the beginning of the study; but in 1948–1949, the percentages had increased to 85 to 95. Lower molars were present in only about 60 to 70 per cent at the start, but increased to 85 to 90 per cent in the earlier period. A marked decrease in the percentages of children aged 8 years who still had their deciduous molars occurred in the later period.

The low percentage of molar teeth present at the beginning in 8 year old children cannot be explained on any other basis than early tooth loss because of carious destruction, as the normal shedding time for these teeth is 10 and 11 years.

The Relation Between Presence of Deciduous Teeth, Eruption of Permanent Teeth and Corresponding Teeth Not Present

Percentage charts showing the proportions of children with deciduous and permanent teeth numbers 3, 4, and 5 present and the corresponding tooth-numbers not present for 9, 10, 11, and

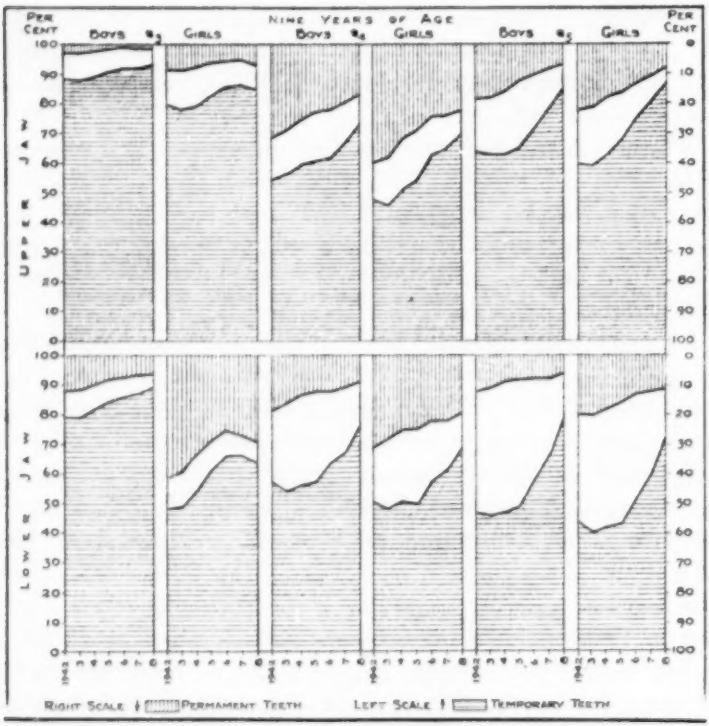


Fig. 9. For 9 year old boys and girls, per cent with deciduous teeth numbers 3, 4, and 5 present (left scale, read up) and per cent with permanent teeth numbers 3, 4, and 5 erupted (right scale, read down). Three-year moving averages for combined population of three cities, villages, and Gjerpen, 1941–1949.

12 year old children demonstrate interesting patterns for the period 1941–1949. (Figures 9, 10, and 11, and Table 11.)

The sex difference as to loss of temporary teeth and as to eruption of permanent teeth is very clearly demonstrated. The difference is greatest for tooth number 3, deciduous and permanent, and least for tooth number 5, deciduous and permanent. Furthermore, it is seen that the sex difference between the per cent of deciduous teeth present and that of permanent teeth erupted is about equal for the cuspids (No. 3) in all three age groups, while the sex differences as to loss of deciduous teeth is

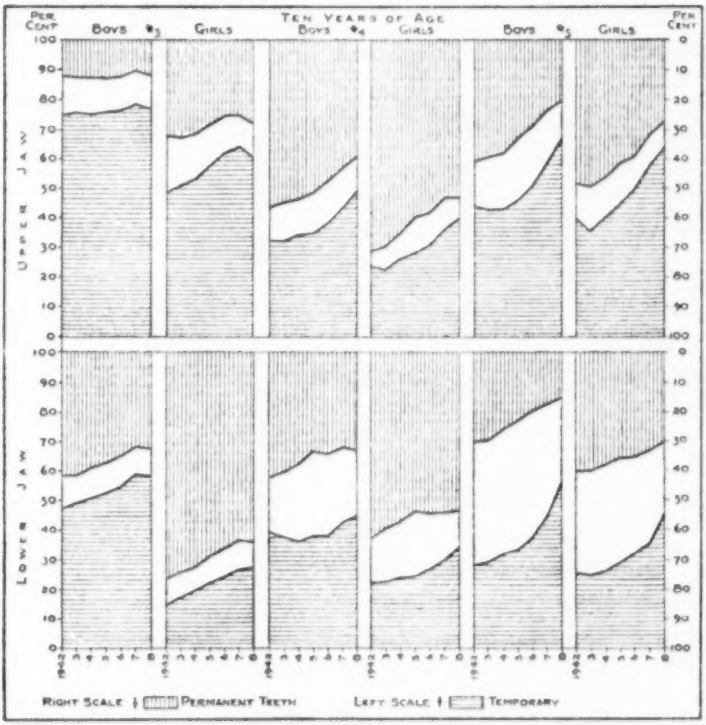


Fig. 10. For 10 year old boys and girls, per cent with deciduous teeth numbers 3, 4, and 5 present (left scale, read up) and per cent with permanent teeth numbers 3, 4, and 5 erupted (right scale, read down). Three-year moving averages for combined population of three cities, villages, and Gjerpen, 1941–1949.

smaller than that for eruption of permanent teeth in numbers 4 and 5 as a whole. This difference is least for tooth number 5 and practically eliminated in the upper one. These differences may be attributed, at least partly, to the amount of premature loss of the specific deciduous tooth. This is highest for the second molar (No. 5) and practically zero for the cuspid, particularly in the lower jaw. The normal process of shedding and that of eruption probably has not been disturbed by extractions for tooth number 3 as is the case for the other teeth. This is also reflected in the more regular unshaded area for tooth number 3,

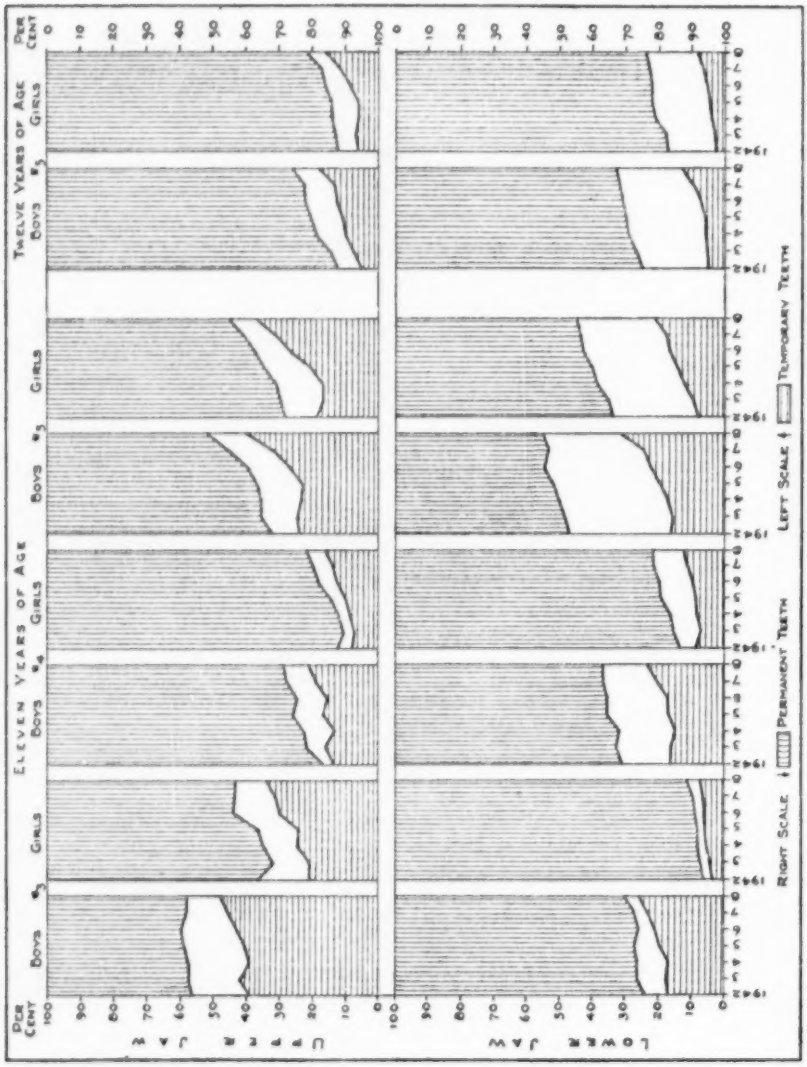


Fig. 11. For 11 year old boys and girls, per cent with deciduous teeth numbers 3, 4, and 5 present (left scale, read up) and per cent with permanent teeth numbers 3, 4, and 5 erupted (right scale, read down). For 12-year-olds, per cent with deciduous tooth number 5 present and permanent number 5 erupted. Three-year moving averages for combined population of three cities, villages, and Gjerpen, 1941–1949.

Table 11. Per cent of children with permanent cuspids and bicuspids erupted and per cent with deciduous cuspids and molars present at ages 9 to 12 years for combined populations of cities,[1] villages and Gjerpen, 1941–1949.

Period and Jaw	Boys						Girls					
	No. 3		No. 4		No. 5		No. 3		No. 4		No. 5	
	Dec.	Pm.	Dec.	Pm.	Dec.	Pm.	Dec.	Pm.	Dec.	Pm.	Dec.	Pm.
	AGE 9 YEARS											
Upper Jaw												
1941–43	88	3	54	32	63	19	80	8	47	40	59	22
1944–46	90	1	60	23	65	13	82	6	54	29	67	16
1947–49	94	2	73	17	85	7	85	7	69	23	87	8
Lower Jaw												
1941–43	79	12	57	19	47	13	48	41	50	31	44	20
1944–46	84	8	57	12	49	8	61	28	50	25	43	15
1947–49	89	6	76	9	78	5	63	30	68	20	71	11
	AGE 10 YEARS											
Upper Jaw												
1941–43	74	12	32	57	43	41	49	33	23	72	39	49
1944–46	75	13	34	52	45	33	58	28	28	60	44	42
1947–49	77	12	48	40	67	21	60	28	39	54	64	28
Lower Jaw												
1941–43	46	43	39	43	29	30	15	76	22	63	26	41
1944–46	52	38	38	34	34	23	22	69	24	53	29	36
1947–49	57	33	45	34	56	16	28	64	35	53	46	31
	AGE 11 YEARS											
Upper Jaw												
1941–43	39	44	13	83	24	68	21	63	8	88	18	72
1944–46	40	41	16	74	23	63	24	63	10	85	21	65
1947–49	47	42	21	71	41	48	34	57	16	78	37	54
Lower Jaw												
1941–43	17	76	17	68	16	52	4	94	8	86	8	65
1944–46	20	72	18	64	20	47	6	91	9	81	14	60
1947–49	26	69	24	63	32	44	7	89	12	78	22	55
	AGE 12 YEARS											
Upper Jaw												
1941–43					5	88					6	88
1944–46					11	79					7	85
1947–49					18	74					18	76
Lower Jaw												
1941–43					5	74					3	83
1944–46					7	70					4	78
1947–49					14	67					9	75

[1] Only 3 cities included at ages 9, 10 and 11 years, but total city group at age 12.

representing the percentages of children with neither deciduous nor permanent tooth present, compared with the size and shape of the white area for the molars. The lower cuspids are the most regular with respect to percentage of children having neither deciduous nor permanent present, and these teeth have also the lowest caries rate.

Another sex difference shown in the same charts is the fewer teeth numbers 4 and 5—deciduous and permanent together—in the mouths of boys than of girls. This is illustrated by a narrower unshaded space for girls than boys in the respective age groups. Tooth number 3 in the 11 year group demonstrates the same condition. The irregularities in this respect as to tooth number 3 in 9 year olds and partly in 10 year olds may be attributed to the very small numbers of erupted permanent cuspids and thus the rather unreliable figures obtained. The difference between the sexes in the total teeth numbers 4 and 5 present is due partly to the earlier eruption of the permanent teeth in girls than in boys and thus is a true sex difference *per se*, but is increased by the premature loss of the corresponding temporary teeth.

The very high percentage of children with neither deciduous nor permanent teeth numbers 4 and 5 present at the beginning of the period of study cannot be taken as *normal* even if it may be the common picture where caries is as rampant as in the districts studied. The decrease in rates for teeth not present at the end of the study period may be considered a movement toward a normal condition.

The very high percentages with no lower tooth number 5 present among 9 and 10 year olds would be expected from the great number of deciduous teeth lost prematurely, long before the normal eruption time of the successor. However, the high percentages at 11 and 12 years, the time for normal eruption of the second bicuspid, is remarkable.

It will be noticed that for teeth numbers 4 and 5 the rates for teeth not present are higher in the lower jaw in all age groups. This could be accounted for by a greater loss of decidu-

ous teeth in the lower jaw than in the upper one combined with an earlier eruption of the permanent teeth in the upper than in the lower jaw. It is true that more teeth have erupted in the upper jaw than in the lower one; this is also in accordance with the usual picture of eruption time. According to Hurme, the difference amounts to about 3–4 months for these teeth. The deciduous tooth number 4 is present almost to the same extent in the lower jaw as in the upper one and the higher eruption rate for the permanent tooth in the upper jaw can account for the lower rate of teeth not present in that jaw. For tooth number 5, however, the percentages of deciduous ones present are much less in the lower jaw than in the upper one and if the rates for permanent upper second bicuspids erupted are transferred to the lower jaw the rate of missing teeth still will be much greater in the lower jaw than in the upper one. This particular feature with tooth number 5 may be attributed to the extremely high rate of premature loss of the temporary molar.

The expression "delay" in eruption of permanent teeth has to be related to the eruption status at the beginning of the study. The eruption of the bicuspids at that time may be considered as premature on account of the early loss of deciduous molars and the "delay" in eruption during the later years of study may be looked upon as the more normal condition.

In some instances the curves for erupted permanent teeth and the curves for deciduous teeth present follow each other more or less, chiefly pertaining to tooth number 3, and this may be considered as the normal picture. The steepness of the curves, however, is caused by the special war-time factor. In other instances, however, the curves for erupted permanent teeth are more or less horizontal while the curves for deciduous teeth present are rather steep. This picture may be considered to represent an abnormal condition due to the same factor.

It is clearly seen in the cases last mentioned that with the increase in the per cent of deciduous teeth present, the original percentage of erupted permanent teeth could not be kept up. Even if it may seem that the deciduous tooth is retarding the

eruption of the permanent one, the condition has to be looked upon as a movement toward the true normal one as far as shedding time is concerned. It is not possible to state whether or not the "delay" in eruption time is influenced by another factor in these cases, but it is very likely and it will be discussed later.

In other instances with a more horizontal eruption curve, and a high rate for teeth not present, the increase in the rate of deciduous teeth present would not in any way retard the eruption of the permanent teeth. The "delay" in eruption here may be attributed either to prematurity or to a retardation on another basis. The illustration of the lower tooth number 5 in 9 year olds demonstrates a high premature loss of deciduous teeth but a high eruption rate would not be expected at that early age. The same tooth in 10 and 11 year olds, closer to the normal eruption time of the second bicuspid, illustrates a more interesting situation. Here is seen a clear "delay" in eruption, and even with a great increase in deciduous teeth present, still there is a high rate of teeth not present all through the years. At 12 years of age, in the upper range of the normal eruption time of the second bicuspid, a similar trend is shown. The "delay" in eruption in these instances cannot be caused by persistent deciduous teeth, but must be attributed to a retardation in tooth development and/or tooth eruption.

Figure 6 which shows the average numbers of deciduous and permanent teeth numbers 3, 4, and 5 in 9, 10, and 11 year old children in Gjerpen and Grue also gives an interesting picture of the relationship between the presence of deciduous and permanent teeth. Here it is clearly seen that when the numbers of deciduous teeth increase during the first period the numbers of the corresponding permanent teeth decrease. Comparing the second period of study with the first one, we find the same relationship, but in the opposite direction: the decrease in numbers of deciduous teeth during the second period is followed by an increase in the numbers of permanent teeth erupted. This is most clearly demonstrated in Grue.

The Caries Rate in Deciduous Teeth

In order to discuss the cause of changes in percentages of deciduous and permanent teeth present during the two periods of study, it is necessary at this point to report on the caries rate in deciduous teeth. Changes in the caries rate in deciduous teeth, however, will be discussed more fully in a later report on caries in the permanent dentition.

As most of the deciduous incisor teeth have been shed at the time the Norwegian children enter school, caries could be studied only in the cuspids and first and second molars. Furthermore, the caries rate has been based on the teeth present and not on the total number of teeth having been in the mouth. Thus, the caries figures do not represent the total pathology, past and present, of the deciduous dentition. Even teeth known to have been extracted because of caries have not been counted. The symbol *df*, meaning decayed or filled teeth, therefore, is used to designate the caries experiences analyzed for these deciduous teeth. Since the number of deciduous teeth present in the mouth increased during the first study period as a result of the decrease in the rate of extraction because of caries destruction, the basis for estimating the caries rate is not uniform during the whole study. Therefore, the caries rate is expressed only as the percentage of teeth present that are decayed or filled; and the average number of caries-affected teeth per child has not been computed.

Although on the original records obvious caries and fillings on the respective surfaces were marked, the caries rates for deciduous teeth will be shown only on the tooth basis.

Decayed or Filled Deciduous Teeth at 9 Years of Age. The percentages of deciduous cuspids, of first molars, and of second molars (teeth numbers 3, 4, and 5, respectively,) that were decayed or filled for 9 year old children examined in cities, villages and Gjerpen are shown in Table 12. As previously mentioned, at age 9 years data for these deciduous teeth were available for only three cities in the combined cities group for the first study

Table 12. Per cent of deciduous cuspids and molars decayed or filled for 9-year old boys and girls in specified community groups, by given periods of examination.

Community Group	Boys					Girls				
	3-Year Average			2-Yr. Average		3-Year Average			2-Yr. Average	
	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953
	TOOTH NUMBER 3—UPPER									
3 Cities	51.2	32.1	22.6	21.2	28.7	47.5	38.4	28.7	29.2	32.2
Villages	43.5	33.8	20.3	19.4	—	52.0	36.2	18.6	10.8	—
Gjerpen	48.3	27.0	22.4	20.0	18.6	42.8	39.9	24.8	21.7	15.4
Combined Pop.[1]	46.4	31.4	21.4	—	—	47.3	37.1	23.4	—	—
	TOOTH NUMBER 3—LOWER									
3 Cities	39.5	24.8	16.1	18.4	26.7	42.0	25.8	18.9	19.0	23.2
Villages	25.0	30.2	11.0	8.6	—	38.2	28.3	12.4	7.4	—
Gjerpen	30.5	20.0	10.6	9.4	7.9	29.9	16.1	14.3	15.2	12.5
Combined Pop.[1]	29.6	25.9	12.0	—	—	35.5	23.9	14.9	—	—
	TOOTH NUMBER 4—UPPER									
3 Cities	85.7	75.8	58.7	54.3	77.9	80.4	82.0	62.6	61.9	79.7
Villages	77.4	73.0	58.0	58.5	—	80.4	76.8	57.8	51.8	—
Gjerpen	79.4	71.3	56.9	51.2	72.8	80.5	70.9	65.8	62.0	77.4
Combined Pop.[1]	78.6	73.3	58.0	—	—	80.5	75.6	62.0	—	—
	TOOTH NUMBER 4—LOWER									
3 Cities	86.4	84.3	67.0	60.3	76.3	90.0	87.5	67.0	59.7	75.0
Villages	86.7	79.9	66.8	64.6	—	87.4	81.6	64.1	55.7	—
Gjerpen	88.0	87.6	64.4	59.7	70.4	89.7	83.1	70.2	65.9	73.3
Combined Pop.[1]	87.1	83.1	66.1	—	—	88.4	83.6	66.9	—	—
	TOOTH NUMBER 5—UPPER									
3 Cities	87.8	88.2	73.5	69.5	80.2	90.7	89.0	75.4	72.5	81.8
Villages	91.6	86.2	73.2	73.9	—	93.1	88.0	70.0	65.1	—
Gjerpen	88.9	73.2	58.3	51.4	70.6	84.5	79.9	59.9	53.8	68.8
Combined Pop.[1]	89.7	83.2	68.3	—	—	89.5	85.1	67.7	—	—
	TOOTH NUMBER 5—LOWER									
3 Cities	84.4	85.7	77.8	74.7	78.5	93.8	91.1	75.8	71.4	80.0
Villages	86.5	85.8	73.3	70.9	—	90.9	88.1	73.7	69.8	—
Gjerpen	88.6	83.9	65.5	58.2	72.9	87.7	84.8	74.9	70.6	72.6
Combined Pop.[1]	87.6	85.2	71.5	—	—	89.8	87.6	74.6	—	—
	NUMBER OF CHILDREN EXAMINED[2]									
3 Cities	93	154	153	108	118	94	107	139	90	98
Villages	275	299	278	182	—	281	267	242	143	—
Gjerpen	191	174	220	156	155	165	146	198	131	141

[1] Percentages are based on the sum of the specific tooth populations for the three community groups.

[2] The tooth populations on which the percentages are based are less than the numbers of children examined and differ for each tooth.

period 1941–1949 and for these same cities in 1952 and 1953. For the combined villages, deciduous teeth have been studied only for the first period since few examinations were available for the second period. Data for Gjerpen are available for both periods, and data for Grue are available from 1944 to 1949 and for the second period.

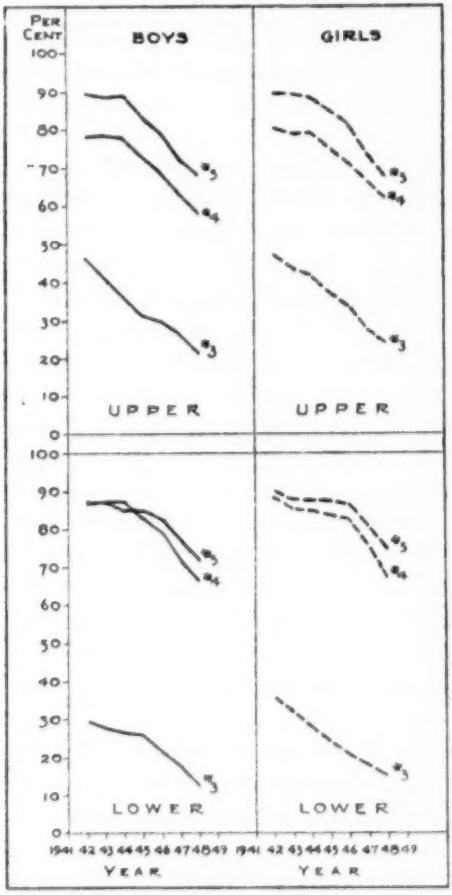


Fig. 12. For 9 year old boys and girls, *df* rates for deciduous teeth numbers 3, 4, and 5. Three-year moving averages for combined populations of three cities, villages and Gjerpen, 1941–1949.

In the first period, 1941–1949, the *df* rates for each of the six deciduous teeth (upper and lower cuspids, first molars and second molars on right side of mouth) and similar for children aged 9 years examined in the three cities, villages and Gjerpen, and differences among the groups are not consistent nor significant (Table 12). Therefore, the populations of these groups were combined; annual *df* rates were computed and three-year moving average values obtained from the annual *df* rates are plotted in Figure 12.

The *df* rate for each of the three teeth numbers 3, 4, and 5 is

nearly the same for boys and girls throughout the study. For the different teeth, the general relationship of the caries rates is similar to that usually found: lowest *df* rates for the mandibular cuspid, much higher rates for the maxillary cuspid, still higher rates for the upper first molar, and highest rates of about equal magnitude for lower first molars and upper and lower second molars.

As will be seen in Figure 12 the caries rate for deciduous teeth was very high at the beginning of the War with about 90 per cent of the second molars present either decayed or filled. In all of the teeth the decrease in caries rate is very marked, ranging from 23–26 per cent reduction for the upper molars, 17–24 per cent for the lower molars, 50–54 per cent for the upper cuspids and 58–60 per cent for the lower cuspids. The percentage reduction is based on the *df* rates for the three-year periods 1947–1949 and 1941–1943. The decrease in caries was greatest in teeth with the lowest caries experience and least in teeth with the highest caries experience.

Since three-year moving average rates are plotted in Figure 12, the curves end with the average *df* rate for 1947–1949 which is not the lowest level for caries in most instances. The trend continued downward slightly in the last three years and, as is shown in Table 12, *df* rates for the final two-year period are usually lower than for the three-year period in each of the three community groups.

As previously mentioned, in the second period, 1952–1953, data are available for 9 year old children only in the three cities and Gjerpen. *df* rates for each of the deciduous cuspids and molars are shown in Table 12 for these two community groups. A marked increase in caries at the later period is shown for upper and lower molars in both community groups, with the exception of the rate for lower second molars in girls in Gjerpen. For the cuspids, an increase in *df* rates occurred in the cities but not in Gjerpen.

In Grue, changes in the caries rates for deciduous cuspids and molars in children aged 9 years followed the same pattern as in

the other communities: there was a sharp decrease in the *df* rates for all of the teeth in the first period followed by an increase in the second period. *See* Table 15 and Figure 16.

df Rates for Deciduous Cuspids and Molars at Ages 7 and 8 Years. For four cities, three villages, and Gjerpen, examinations of children aged 7 and 8 years were available, both for the first period 1941–1949 and the later two-year period 1952 and 1953. For each of the three community groups *df* rates for deciduous cuspids and the molars are shown in Tables 13 and 14. The differences among the three communities in the caries rates for these deciduous teeth at the beginning of the study are not large at 7 and 8 years of age. In Gjerpen, however, the *df* rates decreased more sharply and dropped to a lower level at the end of the first period than in the cities or villages. All three of the community groups show an increase in caries for each specific tooth in the second period but the *df* rates continue to be lower in Gjerpen. Changes in specific community groups will be considered in more detail, but the pattern of trends for caries rates in these teeth is so similar for the three community groups that the combined groups have been used to portray the changes in the two study periods.

In Figure 13, three-year moving average values are shown for the first period 1941–1949 for *df* rates in each deciduous cuspid and molar at ages 7 and 8 years; shown also are two-year averages for the later period 1952–1953 and the last two years of the first period, 1948–1949.

At ages 7 and 8 years, the caries rates are about the same for boys and for girls as was found for children 9 years of age.

A very marked decrease in *df* rates during the first period is clearly evident from the moving average curves plotted in Figure 13. The downward trend is already apparent from the beginning of the period, especially for the upper molars; and from 1944, there is a very sharp decline in the curves for each tooth. The decrease in caries started earlier and was greater for 7 and 8 year old children than for the 9 year old children. For upper molars, the percentage decrease from 1941–1943 to 1947–1949

Table 13. Per cent of deciduous cuspids and molars decayed or filled for 7-year old boys and girls in specified community groups, by given period of examination.

Community Groups[1]	Boys					Girls				
	3-Year Average			2-Yr. Average		3-Year Average			2-Yr. Average	
	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953
	TOOTH NUMBER 3—UPPER									
4 Cities	35.7	24.0	17.7	17.4	23.9	34.6	29.5	18.0	17.4	30.4
3 Villages	35.5	23.0	8.6	9.4	28.0	35.2	29.9	11.5	10.3	31.4
Gjerpen	28.5	19.5	12.6	10.6	16.0	36.9	26.0	13.7	12.6	20.6
Combined Gps.	33.2	22.2	13.0	12.5	22.6	35.6	28.5	14.4	13.4	27.5
	TOOTH NUMBER 3—LOWER									
4 Cities	28.0	19.4	9.5	8.2	17.0	30.9	20.4	9.6	9.7	19.3
3 Villages	23.7	13.8	6.0	6.4	15.9	31.3	19.8	7.1	5.6	17.2
Gjerpen	24.1	11.6	2.6	1.8	7.3	21.0	9.8	2.9	2.8	5.4
Combined Gps.	25.3	14.9	6.0	5.5	13.4	27.7	16.7	6.5	6.0	14.0
	TOOTH NUMBER 4—UPPER									
4 Cities	80.5	69.9	53.3	56.5	79.7	85.4	70.2	56.3	56.5	80.3
3 Villages	76.3	64.3	54.8	53.3	74.5	81.1	68.0	53.5	54.1	78.3
Gjerpen	79.1	61.3	45.0	45.5	71.0	75.5	66.8	46.5	45.0	75.8
Combined Gps.	78.6	65.2	51.0	51.8	75.1	80.7	68.3	52.1	51.9	78.1
	TOOTH NUMBER 4—LOWER									
4 Cities	91.0	76.8	58.9	57.3	85.1	91.5	79.9	62.1	58.5	85.3
3 Villages	89.1	70.0	56.0	53.9	78.4	83.7	77.3	59.3	59.8	76.3
Gjerpen	81.6	71.7	48.4	48.2	71.6	89.7	72.3	53.2	49.1	76.8
Combined Gps.	87.2	72.8	54.4	53.1	78.4	88.3	76.5	58.2	55.8	79.5
	TOOTH NUMBER 5—UPPER									
4 Cities	91.0	83.5	57.5	56.4	82.8	92.1	80.6	63.2	60.9	85.2
3 Villages	87.7	69.7	55.3	53.7	81.5	87.5	80.0	58.0	55.8	80.3
Gjerpen	83.3	59.3	35.6	30.1	69.3	80.0	61.0	50.2	52.7	78.8
Combined Gps.	87.3	70.8	49.5	46.7	77.9	86.5	73.9	57.1	56.5	81.4
	TOOTH NUMBER 5—LOWER									
4 Cities	94.0	87.8	67.5	67.2	87.1	94.1	86.7	72.3	69.3	91.3
3 Villages	90.5	78.3	60.9	59.0	82.1	92.1	82.6	64.6	63.3	86.6
Gjerpen	82.0	73.4	42.6	40.2	74.4	93.0	85.1	59.4	56.5	82.8
Combined Gps.	88.8	79.8	57.0	55.5	81.2	93.1	84.8	65.4	63.0	86.9
	NUMBER OF CHILDREN EXAMINED[2]									
4 Cities	398	446	477	322	394	393	372	453	314	373
3 Villages	327	269	358	235	294	353	269	338	236	248
Gjerpen	146	158	188	114	207	121	162	177	112	189

[1] *df* rates for the combined groups are unweighted averages of the ratesf or the three community groups.

[2] The tooth populations on which *df* rates are based are less than the numbers of children and differ for each tooth. Percentages of children with specific teeth presentare shown in Tables 10a and 10b.

Table 14. Per cent of deciduous cuspids and molars decayed or filled for 8-year old boys and girls in specified community groups, by given periods of examination.

Community Group[1]	Boys					Girls				
	3-Year Average			2-Yr. Average		3-Year Average			2-Yr. Average	
	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953	1941–1943	1944–1946	1947–1949	1948–1949	1952–1953
	TOOTH NUMBER 3—UPPER									
4 Cities	42.4	30.7	22.1	22.8	29.8	45.0	33.8	24.1	26.0	34.4
3 Villages	48.5	31.9	15.6	15.3	29.2	45.0	37.2	19.6	18.1	30.7
Gjerpen	41.6	21.3	12.2	8.8	15.1	43.5	28.5	19.4	14.6	24.1
Combined Gps.	44.2	28.0	16.6	15.6	24.7	44.5	33.2	21.0	19.6	29.7
	TOOTH NUMBER 3—LOWER									
4 Cities	28.2	28.5	16.0	13.6	19.7	35.3	26.9	13.6	10.4	24.7
3 Villages	34.4	21.8	10.4	9.6	15.2	32.9	22.1	11.1	9.4	17.3
Gjerpen	23.6	14.9	5.7	3.6	6.0	23.9	10.6	8.5	5.7	9.8
Combined Gps.	28.7	21.7	10.7	8.9	13.6	30.7	19.9	11.1	8.5	17.3
	TOOTH NUMBER 4—UPPER									
4 Cities	85.2	77.1	53.5	51.7	80.6	87.8	76.4	57.1	58.4	82.7
3 Villages	79.2	67.3	55.0	55.7	72.6	87.1	79.5	58.3	56.8	77.6
Gjerpen	81.8	68.5	45.8	43.2	69.8	86.1	65.9	52.0	45.4	74.2
Combined Gps.	82.1	71.0	51.4	50.2	74.3	87.0	73.9	55.8	53.5	78.2
	TOOTH NUMBER 4—LOWER									
4 Cities	93.4	85.4	65.7	62.5	80.4	90.4	82.5	64.7	62.6	83.4
3 Villages	87.4	82.3	64.0	65.3	75.3	84.6	79.5	63.8	60.2	77.4
Gjerpen	89.4	73.5	53.2	50.0	70.5	90.3	81.6	65.6	63.5	80.7
Combined Gps.	90.1	80.4	61.0	59.3	75.4	88.4	81.2	64.7	62.1	80.5
	TOOTH NUMBER 5—UPPER									
4 Cities	90.9	87.7	66.0	61.6	85.1	94.8	90.3	70.0	66.9	87.0
3 Villages	89.4	78.4	62.4	61.8	78.4	90.8	86.9	65.2	61.8	82.6
Gjerpen	88.9	67.3	43.4	37.6	68.1	87.9	71.4	44.4	39.2	76.2
Combined Gps.	89.7	77.8	57.3	53.7	77.2	91.2	82.9	59.9	56.0	81.9
	TOOTH NUMBER 5—LOWER									
4 Cities	94.0	89.3	70.3	66.7	87.3	95.6	90.1	74.9	73.2	88.6
3 Villages	91.3	84.6	70.5	72.3	81.9	92.1	90.9	73.9	70.8	85.8
Gjerpen	85.6	78.6	49.7	45.5	75.5	89.3	83.6	66.6	61.0	76.7
Combined Gps.	90.3	84.2	63.5	61.5	81.6	92.3	88.2	71.8	68.3	83.7
	NUMBER OF CHILDREN EXAMINED[2]									
4 Cities	363	364	442	283	331	337	317	396	283	289
3 Villages	250	227	300	206	212	263	250	319	219	200
Gjerpen	190	168	207	138	173	150	146	204	131	177

[1] *df* rates for the combined groups are unweighted averages of the rates for the three community groups.

[2] The tooth populations on which *df* rates are based are less than the numbers of children and differ for each tooth. Percentages of children with specific teeth present are shown in Tables 10a and 10b.

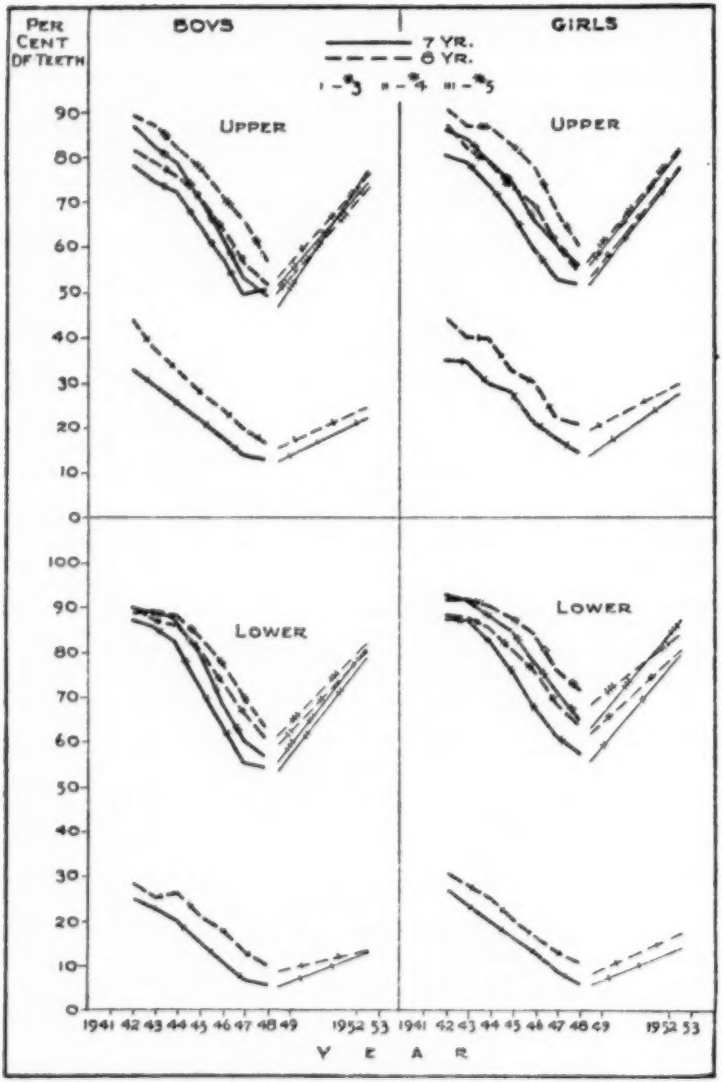


Fig. 13. For 7 and 8 year old boys and girls, *df* rates for deciduous teeth numbers 3, 4, and 5. Three-year moving averages for reduced city group, reduced village group, and Gjerpen, 1941–1949, and two-year averages for 1948–1949 and 1952–1953.

was nearly the same for boys and for girls and about equal at both ages, ranging from 33 to 37 per cent. For the lower molars, the percentage decrease in the *df* rate was slightly less for girls than for boys at both ages, and for both sexes, the decrease was slightly less at age 8 than at 7 years. For both upper and lower molars in 7 year old children, the decrease ranged from 30 to 38 per cent compared with decreases of 17 to 26 per cent at age 9 years.

The greatest percentage decrease in caries is in the lower cuspids, 76 and 77 per cent at age 7 years and 63 and 64 per cent at age 8 for boys and girls, respectively. The decrease in the *df* rate for lower cuspids at 7 years is affected by an extremely low caries rate in Gjerpen at the end of the first period but the cities and villages also show a very great decrease. For upper cuspids, the decrease at age 7 was 61 and 60 per cent, and at age 8 it was 62 and 53 per cent.

The average *df* rates in the last two years of the first period, 1948–1949, for almost every tooth are slightly lower or equal to the average rates for the three years, 1947–1949. However, annual rates show that the downward trend in caries rates had come to a halt or a slight increase had occurred by the year 1949.

The increase in caries from 1948–1949 to 1952–1953 is very apparent in Figure 13 and in Tables 13 and 14. This increase is characteristic of upper and lower cuspid and molars for both sexes at ages 7 and 8 years. Although the increase in *df* rates is very great, in no case is the rate as high as at the start of the study. However, for molars at age 7, the *df* rates in 1952–1953 are approaching the initial level and, for these combined communities, the rates are only 4 to 10 per cent less than the average rates for the first three-year period. At 8 years of age, the caries rates for molars had increased somewhat less than at 7 years and still were about 10 per cent less than the initial average rate for girls and 10 to 16 per cent less for boys. The greatest percentage decrease in caries took place in the cuspids, and the percentage increases from 1948–1949 to 1952–1953 also are highest for the cuspids, but the absolute increases are less than

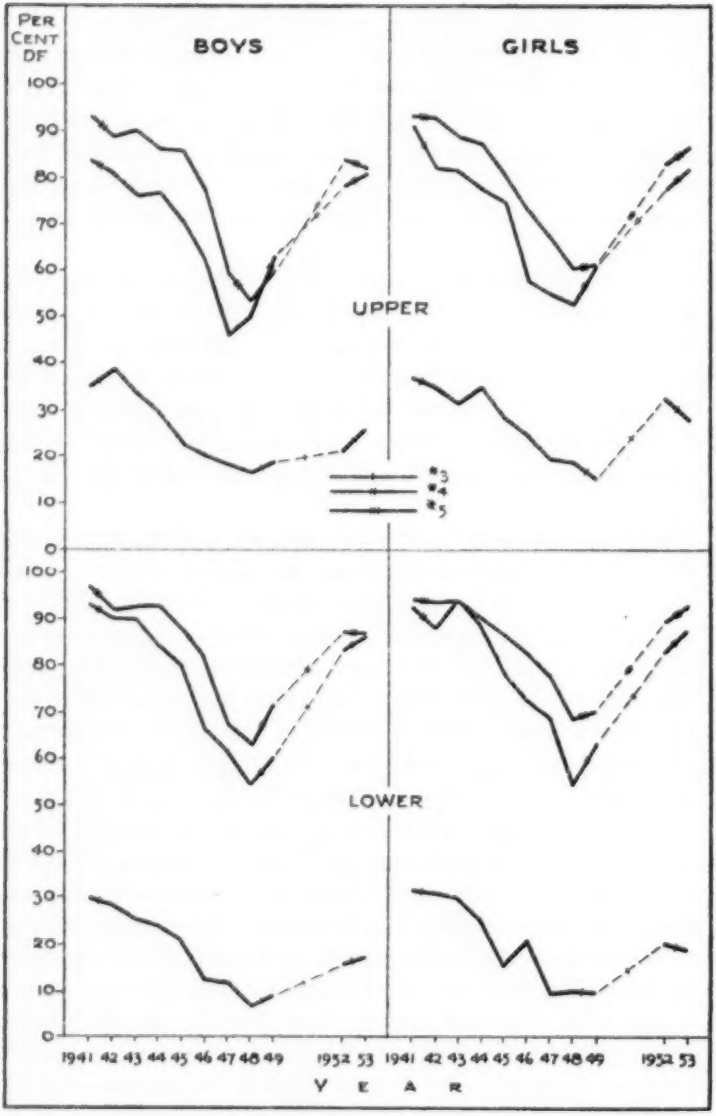


Fig. 14. For 7-year-old boys and girls, *df* rates for deciduous teeth numbers 3, 4, and 5. Annual *df* rates for reduced city group 1941–1949 and in 1952 and 1953.

for the molars which have higher *df* rates. The increase in *df* rates for cuspids was greater at age 7 than at age 8, and at both ages the 1952–1953 rates are much below the initial rates.

In order to show the observed annual *df* rates for the entire study period, annual rates for the four cities are plotted in Figure 14 for 7 year-old children. The curves are fairly typical of other community groups. The rates show a clear tendency to decline from the first school-year 1940–1941, especially the *df* rates for teeth in the upper jaw. The steepest drop in the curves, particularly for the molars is from 1943–1944 or 1944–1945, and the lowest point of the curves usually is reached in 1946–1947 or 1947–1948. There is a definite rise in the *df* rate for molars in 1948–1949.

df Rates in Gjerpen. In order to observe the caries rate for deciduous teeth from the beginning to the end of this study in a single community with a comparable child population examined from year to year, the rates for the village community of Gjerpen are shown in Figure 15.

The three-year moving averages for the *df* rate of teeth numbers 3, 4, and 5 in 7, 8, and 9 year-old children decreased considerably during the first period of study 1941–1949. The greatest reduction in caries occurred in the youngest age group. Here is found a maximum percentage decrease of 76 in the second molar and of 80 in the cuspid. As an average, it may be stated that the *df* rates for the cuspids at the end of the first period are not more than half of those at the start. The observed *df* rates for the cuspids in 1949 for 7 year-old children are somewhat greater in most instances than those for 1948 indicating the beginning of a change toward an increase. Nevertheless, the average rates for the two years 1948–1949 are lower than the three-year average representing the moving average for 1948. For the deciduous molars in the upper and lower jaw in boys and girls the caries rate increased considerably in the second period, 1952–1953. The *df* rates for the upper molars in girls are as high in 1952–1953 as in 1941–1943.

Except for the 9 year-old children, the cuspids also show an

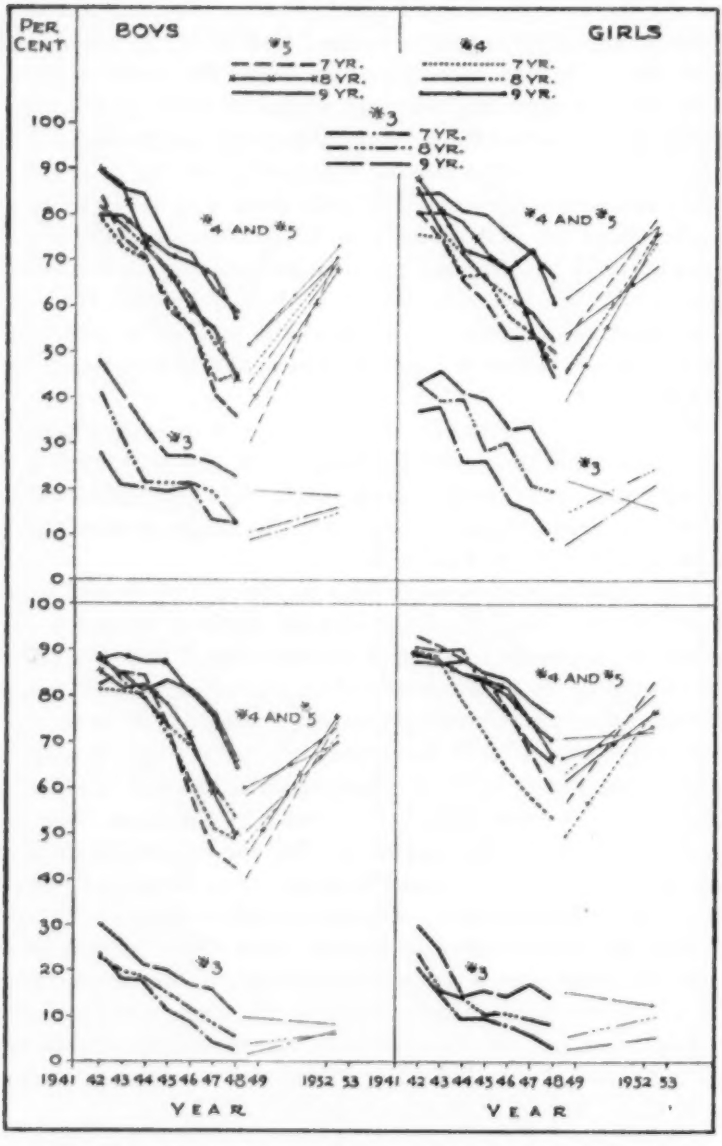


Fig. 15. For 7, 8, and 9 year-old boys and girls in Gjerpen, *df* rates for deciduous teeth numbers 3, 4, and 5. Three-year moving averages 1941–1949, two-year averages 1948–1949 and 1952–1953.

increase in caries rate during the second period, but much less than the molars. The caries rate of the cuspids in the 9 year-old children had not increased.

As a whole, the magnitude of the decrease as well as of the subsequent increase in caries is in this order as far as age is concerned: the 7 year-olds, the 8 year-olds, the 9 year-olds and the 10 year-olds. The last age group is not represented on the graph for technical reasons.

df Rates in Grue. Since the rural community Grue was not included in the study until 1943–1944 no data are at hand from the beginning of the War and this excludes the possibility of obtaining a complete picture of the changes in caries rate during the War. In spite of this and the small number of children, data for this community have given interesting results. From information given by the school dentist on the dental condition at the beginning of the War, it may be safe to state that the caries rate of the temporary teeth was very high.

From Figure 16, showing the moving averages for *df* rates in 8 and 9 year-olds, and Table 15, it will be seen that as an average the caries rate of the temporary cuspids at the end of the first period has fallen to less than half of the rates in 1945. On the basis of the general caries picture during the War, one can take it for granted that the caries rate in Grue had been still higher at the beginning of the War. The reduction in the amount of caries in this community, therefore, seems to have been greater than that in Gjerpen. This may also be inferred from Figures 15 and 16 if the values for 1945 in both of these communities are compared. They are lower in Gjerpen than in Grue.

The reduction in *df* rates of the temporary molars is also very pronounced though not to the same extent as that of the cuspids. This corresponds to the findings in Gjerpen. For cuspids and molars, the caries rate increased from the end of the first period of study to the second period in both 8 and 9 year-old children. This is contrary to the findings for 9 year-olds in Gjerpen, where the caries rates for the cuspids either did not show any changes or continued to decrease during the second

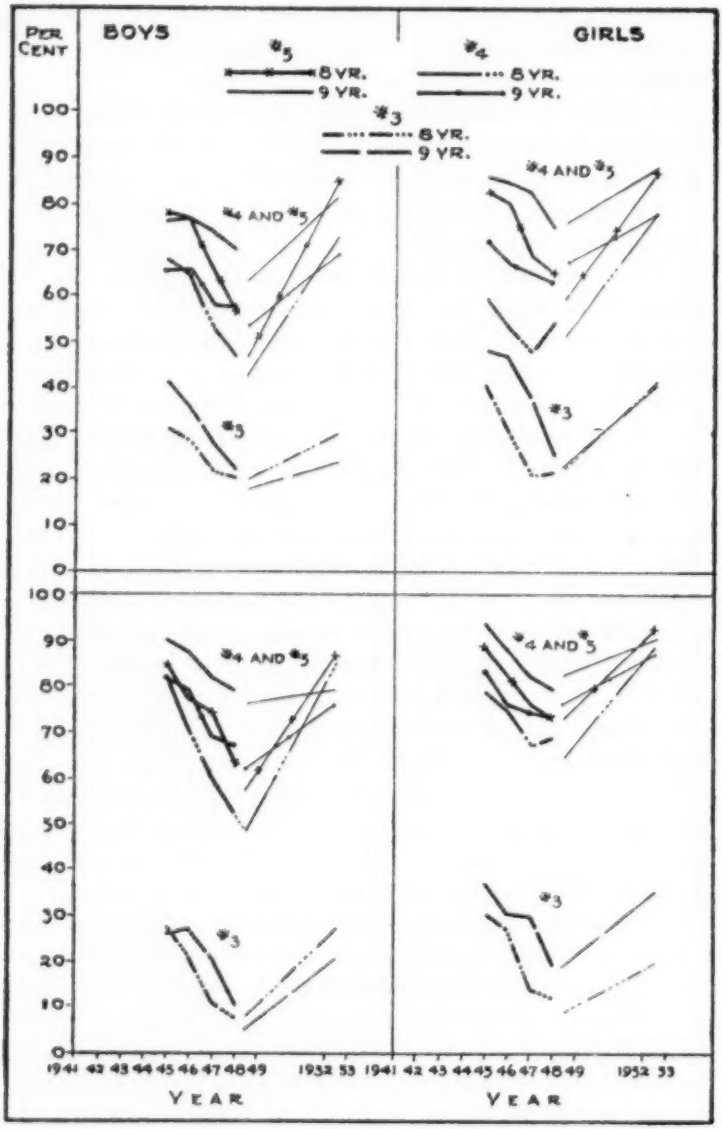


Fig. 16. For 8 and 9 year-old boys and girls in Grue, *df* rates for deciduous teeth numbers 3, 4, and 5. Three-year moving averages 1944–1949, and two-year averages 1948–1949 and 1952–1953.

period. The curves for the cuspids in Grue show a greater steepness than those in Gjerpen both in the decreasing and in the increasing part. A corresponding difference as to the molars is not present.

The caries rates for the molars in Grue at the end of the second period are either higher or at about the same height as the three-year average rates for 1944–1946. This corresponds to the condition in Gjerpen.

As a rule the observed rates for 1949 were somewhat higher

Table 15. GRUE: Per cent of deciduous cuspids and molars decayed or filled for 8 and 9 year old boys and girls, by specified periods of examination.

Tooth Number	Boys				Girls			
	3-Yr. Average		2-Yr. Average		3-Yr. Average		2-Yr. Average	
	1944–1946	1947–1949	1948–1949	1952–1953	1944–1946	1947–1949	1948–1949	1952–1953
	AGE 8 YEARS							
Upper 3	31.3	20.4	20.0	29.9	40.8	22.2	22.7	41.7
Lower 3	27.0	7.6	8.2	27.1	30.6	12.2	9.3	20.0
Upper 4	67.8	47.1	42.4	73.3	59.5	54.6	51.4	78.5
Lower 4	81.7	52.1	48.3	85.1	78.8	69.0	64.5	88.4
Upper 5	78.1	55.8	46.7	85.7	83.3	65.1	59.5	87.1
Lower 5	84.4	63.0	57.6	86.5	89.3	73.6	73.2	92.0
	AGE 9 YEARS							
Upper 3	41.5	21.8	17.7	23.8	48.5	25.4	23.1	41.1
Lower 3	26.3	10.3	5.0	20.7	37.1	18.8	19.0	35.3
Upper 4	65.5	57.4	53.6	68.9	72.5	63.2	67.6	78.4
Lower 4	81.9	67.2	62.1	76.2	83.0	73.1	76.1	87.0
Upper 5	76.7	70.4	63.3	81.7	86.7	75.6	76.3	87.8
Lower 5	90.3	79.1	76.3	79.3	94.0	79.3	82.5	90.0
Number of Children Examined[1]								
Age 8 Years	136	110	61	123	123	141	80	111
Age 9 Years	130	107	67	110	134	120	85	87

[1] The tooth populations on which *df* rates are based are less than the numbers of children and differ for each tooth.

than those for 1948 indicating that a change was beginning in the first period just as in Gjerpen.

In both of these communities the caries rate of the molars has not dropped to the same low level in girls as in boys. But a corresponding difference between the sexes may also be found in 1945 in both communities and in Gjerpen for the mandibular molars.

Discussion of the Causes of "Delay" in Eruption of Permanent Teeth

Two factors may be considered when discussing the causes of "delay" in eruption of permanent teeth during the war-time and first post-war years: (1) The extension of the period of persistence of the deciduous teeth, and (2) the nutritional status of the child.

1. *Extension of the Period of Persistence of Deciduous Teeth.* The permanent incisors, cuspids and premolars are the successors of corresponding deciduous teeth, consequently those teeth cannot erupt before the particular deciduous tooth has been shed or extracted. (Very seldom does a permanent tooth erupt beside the deciduous one, so this may be excluded in this discussion.) Therefore, the extension of the period of persistence of the deciduous cuspids and molars, which has been demonstrated, will lead to a "delay" in eruption of the corresponding permanent teeth during the latter part of the study compared with the starting period. On account of the age of the children in this study, the time of loss of the deciduous incisors could not be investigated. It is, however, a possibility that a similar condition, but to a lesser degree, would apply to the upper incisors which usually have a high caries rate.

2. *The Nutritional Factor.* The consumption of various kinds of protective foods by school children decreased after World War II broke out in Norway.[16] In addition, the need for calories was not met by a large proportion of the children. The insufficiency of the diet was particularly marked for children in

[16] A later section on diet and nutrition will present more detail on changes in diet during the War period.

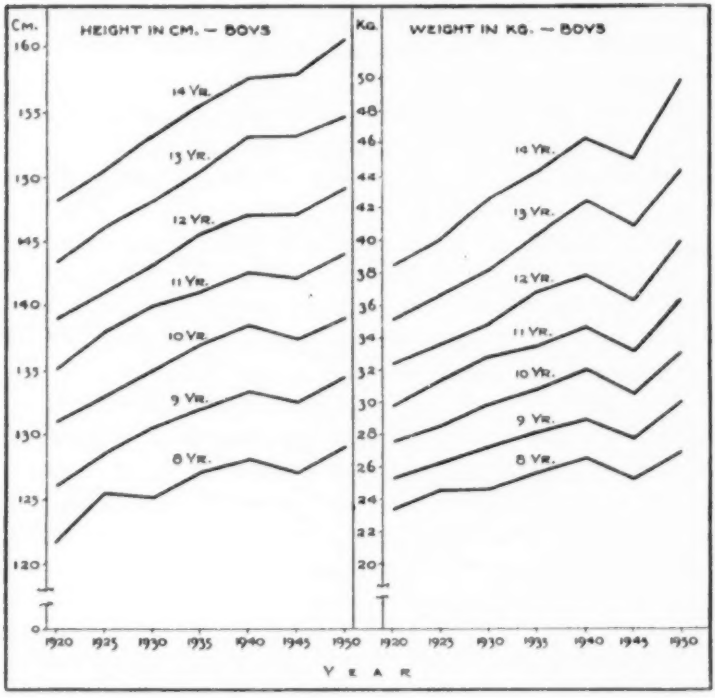


Fig. 17. Average height and weight of boys 8 to 14 years old in Oslo, 1920–1950. Plotted from tables by courtesy of the School Medical Service of Oslo.

the ages of prepuberty and puberty, periods of rapid growth. A clear illustration of the influence of the war-diet on the physical development of school children in Oslo is found in Figures 17 and 18 which show trends in the height and weight of children 8–14 years of age. As will be seen, both the height and the weight of children increased considerably from 1920 to 1940, but stopped increasing during the War. Both for girls and for boys the average weight decreased at every age from 8 to 14 years. The average height also decreased for girls at all ages, and for boys at ages 8, 9, 10, and 11 years. The curves for height of boys 12, 13, and 14 years old levelled off in 1945. After 1945 the height as well as the weight of both sexes and all ages again

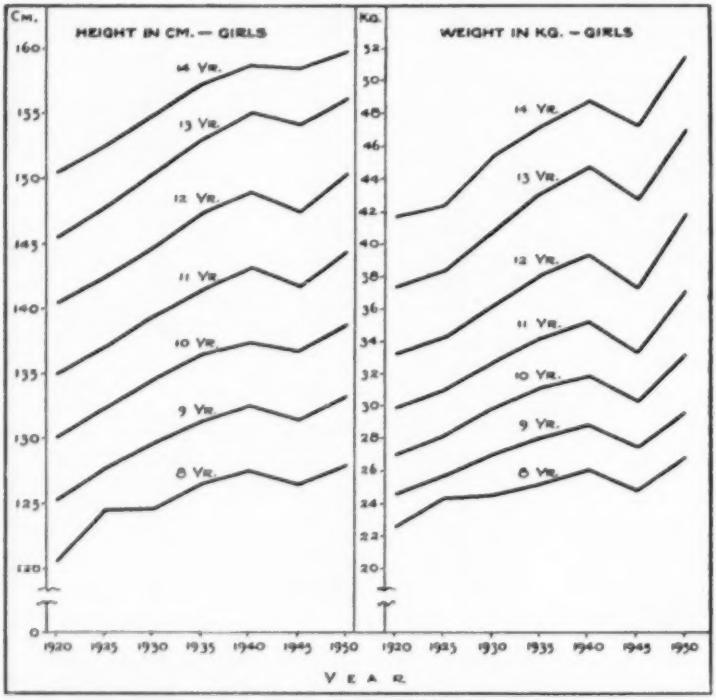


Fig. 18. Average height and weight of girls 8 to 14 years old in Oslo, 1920–1950. Plotted from tables by courtesy of the School Medical Service of Oslo.

increased, and the steepness of the curves from 1945 to 1950 is about the same as that just before the War. Unfortunately, no similar data have been reported from any of the districts included in the present dental studies. However, it is of great interest to observe that the rate of dental caries in Oslo school children showed about the same decrease during the War followed by an increase in the later years, just as in the present material.

From the above evidence on the effect on height and weight of diets during the War, it seems a reasonable possibility that the development, including eruption, of the teeth also could have been affected.

Role of the Two Factors. The "delay" in eruption of permanent teeth in this material does not apply only to the successors of temporary teeth. For all of these teeth, however, a decline in the eruption curve is indicated; but except for the lower lateral incisor, changes in the age of eruption for the incisors are small and much less than for the other teeth. The two permanent molars located posterior to the deciduous dentition are unaffected by the presence or absence of the deciduous teeth; of these, the second molar shows a more significant delay in eruption. (The first molar may erupt earlier than normal when the second deciduous molar has been extracted at 4 or 5 years of age, but this is so rare that it would not affect the rates.)

The slight "delay" in eruption of the first permanent molar and the highly significant delay in eruption of the second molar, thus, cannot be attributed to a local factor pertaining to the deciduous dentition. The only cause of the delay in eruption of these teeth must be a nutritional one. The reason that the first molar shows rather small changes in eruption time compared with the second molar may be associated with a difference in nutritional status between preschool and school children. As mentioned before, school children in Oslo showed a definite retardation in height and weight during the war years compared with the pre and postwar periods. No systematic studies have been published on the physical development of preschool children in Norway during the War. However, information from Sagene Health Station for Mothers and Children in Oslo, may prove that children in the lower ages were not affected physically in the same way as older children. According to the food-rationing system, children up to 5 years of age had nearly normal allowances of protective foods as well as of calorie-supplying foods. Neither of these requirements was met for school children. From our knowledge of the diet available, and the recorded impairment of physical development of school children, there is good basis for the conclusion that the "delay" in eruption time of the permanent molars has to be attributed to a nutritional factor.

In what way impaired nutrition caused the delay in eruption of the molars is not possible to answer by the present study. It may have been through a slowing down of the process of root development or the process of tissue resorption necessary for emergence of the crown of the tooth through the bone and gingiva. Both of these processes, however, are related to cell function.

If the delay in eruption of the permanent molars is attributable to a nutritional factor, this may also be true as to the delay in eruption of other permanent teeth. On the other hand, as stressed before, the permanent teeth replacing the temporary ones cannot erupt before the deciduous teeth have been shed. The first permanent molar erupting around the sixth year demonstrates rather small differences in eruption time. The incisors, erupting at about the seventh and eighth year, show a greater delay. The bicuspids erupting at the ages of 10 and 11 years and replacing the temporary molars, show the greatest delay. Among the deciduous teeth, molars are the most prone to decay; the cuspids take an intermediate position in this respect. Thus, the permanent teeth showing the greatest delay are those which erupt late, and also are the teeth replacing deciduous teeth with the highest caries incidence. The curves for eruption of the bicuspids have a much steeper decline and show much more significant changes than the curve for the second molar. Even if the steepness of the curves cannot be taken as an absolute measure of the change in eruption time, the difference between the cuspids and the second molars in the shape of the curves is so pronounced that it may be safe to conclude that another factor also had been operating.

The great delay in eruption of the lower lateral incisor compared with the other incisors is rather puzzling. This tooth has one of the lowest caries rates and thus should not have had a high extraction rate at the start of the study. If the delay in eruption during the later years of study, was due chiefly to impaired nutrition, one should expect the same to be true for the other incisors.

Earlier Studies on the Time of Eruption of Permanent Teeth in Relation to Nutrition and Body Growth. The literature contains many reports dealing with the time and sequence of eruption of permanent teeth. Some of these publications also have reference to the relationship of general physical development and nutrition of the child, and will be briefly discussed.

Dietlein (1895) states that children born of rich parents shed their deciduous teeth and get their permanent teeth earlier than children born of poor parents. In city children (in Freiburg) he also found earlier eruption than in rural children. He ascribes the earlier eruption to better nutrition and housing. He also mentions the earlier eruption of permanent teeth in girls than in boys. Röse (1909) reports on extensive studies on the time of eruption of permanent teeth and confirms the statements of Dietlein, but emphasizes that the race factor has to be considered, too, in discussing the variation in time of eruption. He did not find any difference in time of eruption between right and left side of the mouth. Hellman (1923) studied nutrition, growth, and dentition in a wealthy and a poor group of children, ages 6–15 years, in New York. He found that although the wealthy group was accelerated in body growth, it was retarded in dentition, and, on the other hand, while the poor group was retarded in body growth it was accelerated in dentition. The cause of this is not clear, he states, but adds: "An explanation may be found in that the retardation in teething of the wealthy may be due to the care which the teeth receive, or to the excessive demand upon the energy required for growth in general. This demand upon the energy for body growth may reduce that available for the process of dentition. . . . It may therefore be concluded that nutrition has a direct, positive, and stimulating effect upon body growth as a whole, but it appears that the acceleration in body growth has an adverse influence on the process of dentition." Hellman's suggestion that the retardation of teething in the wealthy group compared with the poor group could be due in part to the care of the teeth in the former group may be a better explanation than that concerning the

energy for body growth. From Hellman's publication showing age curves for shedding the temporary teeth together with those for the eruption of the successors in the wealthy and in the poor groups, it is found that the curves for the incisors, and partly for the canines too, are very close to each other in both groups. The curves for teeth nos. 4 and 5 are also rather close together in the wealthy group, but very much apart in the poor group, as much as 2–6 years difference. The largest difference is found in the lower jaw. The eruption curves for all the mandibular permanent teeth for the wealthy and the poor groups are very close together. The curves for the maxillary teeth, however, are fairly far apart for teeth nos. 4 and 5, that for the wealthy being highest, corresponding to the "retardation" in this group. The main difference, therefore, between the wealthy group and the poor group is the time of shedding of the two deciduous molars, it being much earlier in the poor group.

Hellman's statement of "retardation" of dentition in the wealthy group and "acceleration" in the poor group is mainly to be referred to teeth nos. 4 and 5. The poor children without doubt lost their deciduous molars early because of untreated caries while the wealthy children had repair treatment. Thus, the main difference in dentition between these two groups of children cannot be related to "difference in energy for body growth." However, nutrition may be an indirect factor inasmuch as it may have influenced the caries development. As to the eruption of the permanent teeth having no precursor, Hellman's figures show that the mandibular first and second molars erupt somewhat earlier in the poor group than in the wealthier group. In the upper jaw there is practically no difference in boys, and in girls the small difference is reversed. Only half of the dentition was examined.

As to Hellman's statement on the "antagonism" between body growth and dentition, it should also be remembered that in spite of the greater height and weight of girls compared with boys from 11–15 years, the girls have more erupted permanent teeth at any age.

Gebhart (1925) reports on the time of shedding of temporary teeth and eruption of permanent teeth in 1,150 Italian boys and 1,200 girls of ages 4–13 years, in New York. Comparing these children with those in Hellman's study, he finds that the Italian children show about the same picture of physical growth and dentition as the poor-group children studied by Hellman. Thus, he reports an acceleration and retardation respectively of shedding and eruption fairly much the same as Hellman. Plotting the figures for shedding of the deciduous teeth and for eruption of the successors from Gebhart's publication, it is found that the two curves are almost identical for teeth nos. 1, 2, and 3 but fairly far apart for teeth nos. 4 and 5. The maxillary teeth in girls show some irregularities.

The same comments, therefore, may be made on Gebhart's interpretation as on Hellman's. Gebhart reports somewhat earlier shedding on the right side than on the left side both by girls and boys, and the eruption of permanent teeth is also earlier in the right side in boys but the reverse in girls.

Wuorinen (1926) studied the eruption time in 7,155 Finnish children aged 4–16 years. His material for three different social groups unfortunately was pooled. He admits that the eruption of teeth without doubt is influenced by living conditions, but states that in Finland no great difference exists in that respect among the social classes. Wuorinen did not find any time difference in eruption between right and left side of the mouth, and thus he could not confirm the statement of Gebhart.

In the very extensive dental studies in Swedish Norrland and Skåne (1929–1931), Holtz (1934) found that the shedding of the deciduous teeth and the eruption of the permanent teeth were retarded in children in the most remote communities (Steensele) compared with a community situated more centrally (Skåne). The children showing the retardation did not have more than about one third as high caries frequency as the other children. The retardation in shedding of the deciduous teeth thus may be ascribed to less carious destruction of these teeth. As no differentiation between the various morphological

groups of teeth is published, it is not possible to see if the retardation pertains chiefly to the molars. The retardation in the eruption of the permanent teeth may be attributed to a longer persistence of the temporary teeth.

Ekman (1938) reports on a study of the time of eruption of the permanent teeth in 16,991 Finnish children aged 5–18 years. As to the difference in eruption time between social classes, he finds that rural children are later eruptors than urban children. The cause of this difference is not discussed except for mentioning that the urban children usually are more advanced in general physical growth. Among the urban children of Helsinki there was no difference in eruption time between children in public schools and children in "higher" schools. He emphasizes, however, that the material in these two groups does not differ very much.

Stejling-Lindeboom and coworkers (1948) report on retarded eruption of permanent teeth in Dutch children during the Second World War. Mention is made of further studies to see if the nutritional factor could have been responsible, but no further reports have been found. This delay in eruption time, leading to a decrease in post-eruptive tooth age, is stated to be the cause of the small decrease in caries frequency observed in some groups of children.

Stones, Lawton, Bransby, and Hartley (1950) studied the time of shedding of deciduous teeth and the time of eruption of permanent teeth in 189 boys and 140 girls aged 2–14 years. The number of children in each age group is very small, but in spite of this the general findings are in close agreement with those from other studies. The most interesting thing in this study is that the average age of loss of deciduous teeth is computed both excluding and including the extracted teeth. By plotting the figures for shedding, excluding and including extractions, and for eruption of the corresponding permanent teeth it is found that the curves for the shedding of teeth nos. 1, 2, and 3 are identical, but the curves for teeth nos. 4 and 5 including extractions are much lower than those excluding extractions. Unfor-

tunately, the average time for eruption of the permanent teeth has been calculated irrespective of whether the predecessor has been extracted or shed. This study, therefore, does not give any information on the difference in eruption time when the predecessor has been lost early by extraction or shed at the regular time.

Talmers (1952) found in his studies of the time of eruption of the permanent second molar in relation to body size and areolar development that both boys and girls with early eruption usually were advanced in height and weight for their chronological age. Corresponding to this, children showing late eruption were also below average in height and weight. Among 36 girls sexually matured early, 30 were advanced in dental eruption. All these relationships were statistically significant. Late eruption was more in agreement with body development than was early eruption.

Clements, Davies-Thomas, and Pickett (1953) report on the eruption of permanent teeth in 1,427 boys and 1,365 girls aged 5–13 years in connection with the Birmingham Anthropometric Survey in 1947–1948. The general picture of eruption corresponds to earlier findings. Of great interest is the comparison of the mean eruption time with figures from corresponding studies of English children in 1912 and 1925. Except for the premolars, the eruption of the other teeth is earlier in the last study than in the former ones. The earlier eruption is attributed to an improvement in the socio-economic condition with an acceleration in physical growth, an assumption which was corroborated by the present study. The late eruption of the premolars is attributed to an improvement in the condition of the deciduous molars with fewer early extractions. The authors also found more teeth erupted in children having reached puberty than in children of the same chronological age but not showing signs of puberty.

In his report on the extensive studies of the variation in the age of shedding deciduous teeth and eruption of permanent teeth, Parfitt (1954) writes: "The age of eruption of permanent

teeth may be affected by early loss of deciduous teeth, and, when comparing the age of eruption in different nationalities, this effect must be considered." Unfortunately, he has not been able to differentiate in the deciduous dentition between cases of early loss by extraction and loss from physiological resorbtion so no comparison is given between the eruption time when the predecessor has been extracted and when it has been shed.

A retardation of eruption and shedding of deciduous teeth and retardation of eruption of permanent teeth under various systemic pathological conditions have been known for a long time, for instance, by endocrine dysfunction and by rickets. Röse in 1909 stated that rachitic children show a small tendency to delayed eruption of permanent teeth. May Mellanby (1919) describes great retardation in eruption and shedding of teeth in rachitic puppies. Degerbøl (1929–32) in his studies of 11,190 children aged 7–14 years from Copenhagen found a retardation of 2–6 months in the rachitic group compared with the total average. The percentage of rickets was 11.1 in boys and 9.3 in girls, who were characterized by dental hypoplasia.

Short (1944) reports on significant retardation of eruption of permanent teeth in 12 year-old children in Colorado Springs with 2.6 ppm fluorine in the drinking water compared with children from districts with 1.2–1.3 ppm fluorine in the water. The retardation could not be ascribed to a difference in the status of the deciduous teeth as the caries rate of these teeth was the same.

Causes of Extension of the Period of Persistence of the Deciduous Teeth

As to the causes of the extended period of persistence of deciduous teeth, three factors should be discussed: (1) Reduced rate of root resorbtion; (2) Less caries destruction of the teeth; and (3) Extended conservative treatment of the teeth.

1. The impaired nutritional condition, discussed as a factor in slowing down the process of eruption of the permanent teeth, may also have influenced the process of root-resorbtion of the

deciduous teeth. It has also been stated by some that the caries process in a pulp-living tooth may accelerate the resorbtion. With a reduced caries rate during this period the lack of such a factor, if it exists, could be active in the extension of the period of persistence.

2. The great reduction in the caries rate has, of course led to less destruction of tooth substance. In the majority of school dental clinics, from which data are used in the present study, no regular conservative treatment of the deciduous teeth was in the program, and very few of the children got their deciduous teeth treated privately. Extraction of deciduous teeth, often long before normal shedding time, therefore, has to be considered as the main treatment of seriously decayed teeth. Osteitis from infected deciduous roots so common with no treatment of deciduous teeth, may lead to early loosening of the tooth. With the reduced caries rate and the slower caries process, more deciduous teeth have been kept in the mouth for a longer period than before.

3. With the reduced caries rate in the permanent teeth during and soon after the War,[17] many school dentists were able to extend regular conservative treatment to the deciduous dentition, too. In this way, more deciduous teeth, of course, have been saved for a more normal period of persistence.

The last two factors, resulting from a reduced attack rate and extent of decay, have no doubt played the greatest role (and most probably the only role) in the extended period of persistence of the deciduous teeth. This is also in harmony with the fact that the cuspids, particularly the lower ones which have the lowest caries rate, also show the least changes in duration of persistence.

In most instances, the three-year averages for the period 1947–1949 do not represent the terminal values for the first period of study. The observed figures for the school year 1947–1948 and/or 1948–1949, therefore, frequently differ from the last value for the moving average. Changes in eruption rate

[17] To be demonstrated in Part II of this publication.

as well as in persistence of deciduous teeth have taken place during the last part of the first period of study. The greatest changes, however, have occurred after the end of the first period.

The changes which have taken place up to and including the last period of study should be easily explained on the basis of the causes already discussed for the "delay" in eruption of permanent teeth and the increase in number of temporary teeth during the first period of study. The nutritional condition as a whole has improved and the caries rate has increased. As a consequence of the increase in caries, the school dentists no longer have been able to treat the deciduous teeth conservatively, and again have had to extract more deciduous teeth. It is noteworthy, however, that the pre-war dental condition as to time of eruption of permanent teeth has not been reached during the eight years' lapse from the end of the War.

The delay in eruption of permanent teeth without precursors may be designated as a true delay, that of the other permanent teeth may be partly a true delay and partly caused by extended persistence of the deciduous teeth.

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ANNOTATIONS

PLANNED MIGRATION[1]

PLANNED MIGRATION is an excellent study with broader implications than the subtitle might suggest—The Social Determinants of the Dutch-Canadian Movement. It is really an examination of some basic ideas on planned migration using the movement from Holland to Canada as "an example of planned migration under almost optimum conditions." (p. 10) The volume is divided into three basic parts, the first part devoted to Holland, the second part to Canada, and the third part to the Holland-to-Canada movement. A short fourth part gives a summary and conclusions, and there is an excellent twenty page bibliography.

In the first part Petersen examines the decline of the Dutch economy and the continuing high rate of natural increase which have resulted in the present population pressure felt in Holland. Mortality has been reduced in ways that might be envied by other countries of the world. Not only is good medical practice followed, but "the best of modern medical science is made available to the population through institutions associated with their churches or other groups to which they are bound by strong sentiments. Such a system has combined the advantages of the specialist and the family general practitioner; for the increase in technical efficiency is not counteracted by a decrease in rapport with the patient." (p. 32)

Combined with the reduction of the death rate has been a continued high fertility. Petersen gives good evidence to support his conclusion that this has been due to the increase in

[1] Petersen, William: PLANNED MIGRATION: THE SOCIAL DETERMINANTS OF THE DUTCH-CANADIAN MOVEMENT. Berkeley, University of California Press, 1955. 273 pp. $3.50.

urbanization (population concentration) without a corresponding increase in urbanism (urban ways of living). The history of Holland and the subsequent developments have been such that the traditional values are supported and maintained by tax-supported institutions such as the religious schools. Even the development of industry has taken place in such a way as to minimize its effect on traditional values that support the large-family system. After World War II the introduction of the family-wage has also supported traditional values.

Three socially accepted methods of relieving population pressure have been undertaken in Holland. Industrialization has not been effective because of the fear of the social consequences of industrialization and urbanization. Efforts have been made to establish the factories in the country rather than move the people to industrial centers. The result has been expensive and relatively ineffective. Draining the Zuider Zee in order to increase the amount of land available is continuing but is completely inadequate to meet population increases. Also the practice of shifting young farmers from restricted circumstances to a plot of their own encourages them to raise larger families and in the long run will probably intensify the population pressure it was designed to alleviate. Sponsored emigration has failed to meet its goal of 40,000 to 60,000 emigrants a year even though the government is now training aspirant emigrants in trades and languages. The major restrictions at the present time are those of other countries on immigration.

In Canada the English and French Canadians and capital and labor have varying feelings on immigration. There is little overt opposition to immigration and most of the objections are in terms of economic and geographic points, although the basic reasons are almost certainly such factors as ethnocentrism, the protection of special interest groups, etc. The traditional encouragement of agricultural immigrants does not reflect Canada's present economic requirements. "Canada has both the material and the spiritual elements essential for rapid development—the capital, raw materials, and power, on the one hand, and the verve and organizing ability on the other hand, to bring these together into a great industrial nation. Her one lack is people. . . . but the determinants of immigration policy,

as has been noted several times, are as broad as society itself." (pp. 151–152)

Three factors are important in looking at the characteristics of the Dutch migrants to Canada. In the first place they are encouraged because they are agriculturists. However, very few have settled in the Prairie Provinces; most of them do dairy and vegetable farming around urban centers. In the second place the Canadians favor the Dutch because they are Nordic. The rational part of the preference for Nordics is probably based on the assumption that they are more easily assimilated. The available data do not make it possible to check this assumption. The third factor is the Orthodox-Calvinist church. Early migration established the Orthodox-Calvinist church in Canada and the ties between the Canadian branch and the Dutch branch encourage migration; 40 per cent of the sponsored Dutch migrants from 1948 to 1952 belong to this group.

Petersen's chapter on Migration and Population Growth is an excellent discussion of various theories relating these two factors. As relates to Canada he concludes, "Thus, the commonsense view that immigration is increasing the population is essentially correct for present-day Canada. The unemployment rate is not a satisfactory index of absorptive capacity, nor can this concept be usefully defined by any other criterion." (p. 221)

Some of Petersen's concluding comments are well worth quoting:

> For the particular case of Dutch-Canadian migration, this study has attempted to prove that the administrative controls set up in both countries have been established more in response to irrational pressures than as rational means of solving a social problem. . . . since our ignorance of social processes as a whole is thoroughgoing, planning in many areas tends to be a hit-or-miss affair, with social science (and social scientists) used largely to justify policy adopted for non-scientific reasons.
>
> American sociology spent a long and fruitless adolescence studying "social problems" before it was learned that the prior task was to study society. Today, when there are more social problems than ever before urgently demanding solutions, pressure is being applied to return to that social-welfare frame of

> reference. Physical and natural scientists may legitimately concern themselves with pure theory; but since sociologists have yet to evolve their first general theory, they must devote their main effort to applying their empirical generalizations. In this study, the answer to the question, "Knowledge for what?" is "For knowledge's sake"; and the answer to many of the specific questions raised in this monograph is the only one that our lack of knowledge permits: "I don't know."

It is impossible to do justice to a volume as "meaty" as this one in a review and some aspects of the discussion have not been touched. It is highly recommended reading for anyone interested in international migration, fertility, or general population.

DANIEL O. PRICE

THE INDEX

TO THIS VOLUME HAS BEEN REMOVED FROM THIS POSITION AND PLACED AT THE BEGINNING OF THE FILM FOR THE CONVENIENCE OF READERS.

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